Learning to Achieve

A REVIEW OF THE RESEARCH LITERATURE ON SERVING ADULTS WITH LEARNING DISABILITIES

National Institute for Literacy

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The National Institute for Literacy, a Federal government agency, is a catalyst for advancing a comprehensive literacy agenda. The Institute bridges policy, research and practice to prompt action and deepen public understanding of literacy as a national asset.

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Table of Contents

Foreword

Introduction and Scope

Learning disabilities (LD) begin in childhood and persist throughout the life span. These neurologically based disorders affect critical learning processes, such as the acquisition and development of reading, writing, and mathematical skills, all of which are essential to every aspect of adult life in the 21st century. The manifestation of LD may change as individuals develop and respond to varying performance demands—for example, when leaving school and entering the workforce. But if LD are not adequately addressed and managed, they can limit adults' prospects for education, employment, and interpersonal relationships.

As neuroscientific and other research is beginning to shed light on the causes and effects of LD, educators, policy makers, and others must apply relevant findings to the development of educational programs, methods of diagnosis, and policies that stand to improve services to adults with LD and ultimately their learning outcomes. The National Institute for Literacy (the Institute), a federal agency charged with providing leadership to the adult literacy field, is committed to identifying research findings that can be shared with practitioners serving adults with LD. Continuing its long-standing involvement in the field of adult LD, the Institute commissioned the present literature review to develop a foundational document that reflects the current knowledge base.

Findings from *Learning to Achieve: A Review of the Research Literature on Serving Adults With Learning Disabilities* will inform a new professional development program to be offered to practitioners and others working with adults with LD. The six topics covered in the review—assessment, English language learners, accommodations, teaching methods, transition, and impact of LD—address needs and issues consistently raised by service providers working in the field. It is the hope of the Institute that this publication will be helpful in advancing scientifically based practice for adults with LD and in encouraging continued investigation to build a larger and more comprehensive knowledge base.

The Institute is most grateful for the effort the authors invested in reviewing the literature and writing the research syntheses. The authors are preeminent scientists and practitioners in the field of LD and adult education and were chosen for their outstanding expertise and knowledge. The Institute also thanks TATC Consulting for its commitment and support in planning, organizing, and creating this publication. Furthermore, the Institute wishes to acknowledge Dr. Juliana Taymans for her invaluable guidance and for maintaining communication with the authors throughout the process. Last, the Institute extends its sincere thanks and appreciation to the peer reviewers of this publication.

Debi C. Basu
National Institute for Literacy

Chapter 1
Introduction

Juliana M. Taymans

A significant number of adults in the United States demonstrate inadequate basic skills. Approximately 20% to 30% of adults in the United States lack the literacy skills needed to meet the reading and computation demands associated with daily life and work (Lasater & Elliott, 2005). Despite societal trends that demand increased literacy skills, census data indicate that more than 40 million American adults have not attained a high school diploma or its equivalent (Lasater & Elliott, 2005). According to the results of the National Assessment of Adult Literacy (NAAL), a national survey of adult literacy, 11 million Americans are nonliterate in English; 30 million possess Below Basic skills, indicating challenges in reading beyond the most simple and concrete tasks; and 63 million can perform everyday basic literacy activities but have difficulty reading technical information or extended prose (Kutner et al., 2007, p. 2). In addition, 46 million function at the Below Basic level when faced with quantitative literacy tasks (Kutner et al., 2007, p. 35).

About 3 million adults attend a variety of federally funded adult education and training programs designed to target the specific needs of the populations they serve (National Commission on Adult Literacy, 2008). Adults with the lowest literacy levels enroll in adult basic education (ABE) for instruction in reading, writing, and math fundamentals. Some English classes for speakers of other languages also address basic reading and writing as well as conversational English needed for everyday interactions. Many speakers of other languages face the additional challenge of limited literacy skills in their native language that can slow their learning progress. Individuals 16 years and older can also enroll in programs to achieve a high school credential through adult secondary education (ASE) and general educational development (GED) programs. In addition to developing advanced literacy skills, these programs teach traditional academic content, such as science and social studies, associated with a high school education.

There are also a variety of programs that directly address employment-related needs. Job Corps targets vulnerable teens and young adults ages 16 to 24 who want to prepare for specific careers or attain the education necessary to qualify for the military or higher education programs. Temporary Assistance for Needy Families (TANF) addresses the needs of adults who can benefit from developing work-related basic skills to end their welfare status. These basic skills go beyond traditional literacy activities to address planning and communication skills important in finding and keeping employment. Workplace literacy programs are offered to employed adults in conjunction with businesses. Although programs typically target basic reading, writing, and math skills, they do so in the practical context of workplace demands by addressing issues such as job safety, technology skills, and communicating with coworkers, supervisors, and customers.

Adult education and training programs also include family literacy programs that simultaneously promote adult and child literacy. A typical family literacy program guides adult caregivers in child-centered literacy activities such as side-by-

side reading, storytelling, arts and craft activities, and educational computer games. The goal of family literacy programs is to increase the literacy and life skills of both caregivers and their children.

Although the exact prevalence is not determined, a subset of the individuals who enroll in adult education and training programs are individuals with either diagnosed or undiagnosed learning disabilities (Kirsch, Jungeblut, Jenkins, & Kolstad, 1993; Ryan & Price, 1993; U.S. Department of Labor, 1991). The NAAL survey results indicated that 6% of the adults surveyed reported having learning disabilities. On average, these individuals had lower prose, document, and quantitative literacy skills than adults without learning disabilities (Kutner et al., 2007, p. 30). Not surprisingly, adult education and training programs serve a higher percentage of adults with learning disabilities than the population statistics would suggest (Corley & Taymans, 2002). For example, Mellard and Patterson (2008) found that 29% of the participants attending 13 Adult Education and Family Literacy Act programs (not including English as a second language [ESL] services) reported having one or more learning disabilities. Welfare-to-work programs also report serving a large number of low-literacy individuals, with 25% to 35% of their participants considered to have learning disabilities (National Governors Association, 1998).

There is no single common profile for an adult student with learning disabilities; age, formal diagnosis, and high school completion are documented sources of variability. A recent study of adult education program participants found that middle-aged individuals (ages 46 to 55) were more likely to identify themselves as learning disabled than younger participants (Mellard & Patterson, 2008). Younger adult students are more likely to have a formal diagnosis than older students because of the trend toward improved special education identification in recent years. In the past, lax graduation standards allowed many adults with learning disabilities to exit high school with diplomas despite having significant literacy needs. Today, this is less likely because of increased accountability and more rigorous graduation standards. Regardless of specific individual circumstances, living with a learning disability has the potential to be a major life stressor (Mellard & Patterson, 2008), especially in situations involving formal learning performance.

Adult service providers need research-based information in order to understand and serve adults with learning disabilities, but they face challenges finding and using high-quality resources. Grounding program and instructional practices in research is often complicated by programs staffed by part-time teachers and volunteers with a variety of teaching backgrounds and credentials and limited resources for professional development. The flexible design of adult education and training programs also poses challenges to service providers who must tailor their instruction to settings ranging from high to low tech, enrollment options from open to closed entry, and amount of weekly instructional time from 2 hours to full time. Each of these delivery options, while facilitating access for adult learners, can pose a significant challenge to effectively meeting the needs of adults with learning disabilities. As chapters 4 and 5 in this volume explain, important principles of accommodations and instruction focused on addressing learning disabilities such as technology integration, opportunities for extensive practice, and programming for skill generalization are particularly challenging to implement in many adult education and training settings.

This publication, *Learning to Achieve: A Review of the Research Literature on Serving Adults With Learning Disabilities,* is the result of the National Institute for Literacy's recognition of the expanding research base relevant to educational services for adults with learning disabilities. The literature

reviews included in this document were developed by a panel of experts in the field of learning disabilities with the goal of bridging the gap between research and practice in working with adults with learning disabilities. The six research syntheses presented in this document provide a specific, coherent evidence base for the Institute's new professional development initiative, *Learning to Achieve: A Research-Based Training on Serving Adults With Learning Disabilities.*

Researchers who specialize in learning disabilities have made a clear and compelling case for interventions that are informed by research rather than intuition. For example, there is a substantial body of research on interventions to improve the word recognition skills of individuals with learning disabilities. These interventions are based on directly addressing underlying deficits in phonological processing as well as providing explicit, mastery-oriented instruction (Fletcher, Lyon, Fuchs, & Barnes, 2007). This is in sharp contrast to some popular, unscientific approaches.

> Interventions based on learning styles, perceptual and motor training, instruction "tailored" for auditory or visual learners, the need for multisensory integration, and even less reasonable interventions involving special colored lenses, metronomes, neural patterning, and so on, continue to be promoted for LDs despite lack of evidence for efficacy and proposed mechanisms that are inconsistent with scientific understanding of cognitive processing and brain function (Fletcher et al., 2007, p. 267).

It is important for service providers to have access to information that clearly indicates practices based on research as opposed to those that may be popular but unproven or even discredited. Armed with such information, service providers can make educated choices about the interventions they offer. Understanding what learning disabilities are and are not is important basic information for adult service providers and can help clarify the potential relevance of interventions.

Defining and Identifying Learning Disabilities

The quest for a clear definition of learning disabilities has yet to come to an end (Mercer & Pullen, 2009). The study of learning disabilities can be traced back over a century, while the first legal designation of learning disabilities as a distinct disabling condition in the United States was put in place about 40 years ago. For school-age populations, the Individuals with Disabilities Education Act (IDEA) provides the most widely used definition of learning disabilities (referred to as *specific learning disability* in this law). The IDEA defines a learning disability in terms of such inclusionary factors as (1) a disorder in one or more basic physiological processes such as memory or auditory perception and (2) one or more difficulties in learning specifically identified as listening, thinking, speaking, writing, spelling, reading, and mathematical calculations. The law also identifies exclusionary factors: (1) problems that are the primary result of visual, hearing, or motor disabilities; (2) mental retardation; (3) emotional disturbance; or (4) cultural, economic, or environmental disadvantage.

For adult populations, definitions of learning disabilities can be found in federal policy and guidance associated with such laws as the Rehabilitation Act and the Americans with Disabilities Act Amendments Act (ADAAA). Specific learning disabilities became a qualifying disability for

rehabilitation services under the Rehabilitation Act in 1981 (Vogel & Reder, 1998). The ADAAA also lists specific learning disabilities as a disability category entitled to protection under the act.

The ADAAA and Rehabilitation Act, however, do not establish assessment requirements for learning disabilities, perhaps as a result of continuing disagreements over the quality and appropriateness of the assessments. Both these laws as well as the IDEA presume the presence of specific unseen internal causes in learning disabilities, such as disorders in "basic psychological processes," disorders in "central nervous system processes," or "neurological disorders." Tests of these internal causes have been problematic. Logically, identification of a learning disability should involve finding and measuring an internal cause or causes as described in these definitions. However, tests intended to measure basic psychological processing or neurological deficits have been questioned and criticized for a number of years (Bradley, Danielson, & Hallahan, 2002; Fletcher et al., 2002; Fletcher, Denton, & Francis, 2005; Kavale, 2002; Reschly & Tilly, 1999).

Given the persistent issues in identifying, defining, and assessing learning disabilities, what can be said about the population of adults with learning disabilities who are the focus of the current volume? In 1999, the U.S. Department of Education's Office of Special Education Programs (OSEP) convened 10 organizations that represented parents, state and local practitioners, researchers, and policy makers to construct consensus statements related to learning disabilities (Bradley et al., 2002). The following six resulting consensus statements provide a common framework for understanding the population under discussion in this volume.

CONSENSUS STATEMENT 1: THE CONCEPT OF SPECIFIC LEARNING DISABILITIES IS VALID AND IS SUPPORTED BY STRONG CONVERGING EVIDENCE.

Researchers across areas of specialization in learning disabilities research, policy, and practice refer to a strong evidence base supporting the existence of learning disabilities. Although there is lack of consensus over how to define and measure specific learning disabilities, the reality that learning challenges based in learning disabilities play a role in some learners' lack of success in school and postsecondary functioning is well documented (Bradley et al., 2002).

CONSENSUS STATEMENT 2: LEARNING DISABILITIES ARE NEUROLOGICALLY BASED AND INTRINSIC TO THE INDIVIDUAL.

The concept of neurologically based disorders is related to an individual's predisposition for one or more weaknesses associated with key learning processes that include reading (word recognition and spelling, comprehension, fluency, and automaticity), math (computation and problem solving), and written expression disabilities (handwriting, spelling, and/or composition) (Fletcher et al., 2007). These weaknesses result in performance deficits beyond academics that affect the development of adaptive skills necessary for communication, daily living, socialization, and employment-related demands important for the school years and beyond.

Despite the general acceptance of neurological causality, issues of measurement and diagnosis persist. To date, there are no neurological tests that distinguish people with learning disabilities from other types of low-achieving learners. At the same time, neuro-imaging research is providing a growing evidence base for differences in brain structure and function that may ultimately lead to diagnostic instruments (Fletcher et al., 2002; Fletcher et al., 2007). Chapter 2 discusses the research support for specific assessment measures in identifying learning disabilities in adults, as well as the discrepancy model, based on determining a significant difference between standardized achievement and intellectual ability measures and the newer "response to intervention" (RTI) model that relies on tiers of

instructional intensity accompanied by assessment directly tied to the instruction.

CONSENSUS STATEMENT 3: INDIVIDUALS WITH LEARNING DISABILITIES SHOW INTRA-INDIVIDUAL DIFFERENCES IN SKILLS AND ABILITIES.

Intra-individual variability can affect a range of cognitive processing, academic achievement, and daily living activities (American Institutes for Research, 2002, p. 5), but it is associated primarily with an ability-achievement discrepancy model of LD diagnosis. Establishing a discrepancy between IQ scores and lower-than-expected scores on achievement testing in order to identify learning disabilities continues to be permissible under IDEA regulations and in qualifying for Vocational Rehabilitation Services (U.S. Department of Education, 2005). At the same time, the validity of the discrepancy model is under question. Using RTI has been proposed as a substitute identification process, but it lacks a strong research base.

CONSENSUS STATEMENT 4: LEARNING DISABILITIES PERSIST ACROSS THE LIFE SPAN, THOUGH MANIFESTATIONS AND INTENSITY MAY VARY AS A FUNCTION OF DEVELOPMENTAL STAGE AND ENVIRONMENTAL DEMANDS.

Learning disabilities begin in childhood and persist throughout the life span (Fletcher, 2003). When observed in adulthood, learning disabilities are often manifested beyond educational settings, negatively affecting employment, interpersonal relationships, and/or community integration (U.S. Department of Education, 2005). Thus, identification of adults with learning disabilities must consider a wider range of characteristics and assessment methods than specified by IDEA.

Although learning disabilities are considered intrinsic to the individual, environmental demands and triggers are powerful determinants of who is and is not identified. Performance issues caused by learning disabilities are highly contextualized, and the manifestation of learning disabilities may change with development, environment variability, and performance demands (Mellard, 2003). Chapter 7 describes research on the impact of learning disabilities on adult life.

CONSENSUS STATEMENT 5: LEARNING DISABILITIES MAY OCCUR IN COMBINATION WITH OTHER DISABLING CONDITIONS, BUT THEY ARE NOT DUE TO OTHER CONDITIONS, SUCH AS MENTAL RETARDATION, BEHAVIORAL DISTURBANCE, LACK OF OPPORTUNITIES TO LEARN, PRIMARY SENSORY DEFICITS, OR MULTILINGUALISM.

Individuals may experience learning disabilities in combination with other disabilities and with conditions such as socioeconomic disadvantage or limited experience with academic English. By definition, these exclusionary factors cannot cause learning disabilities. Current identification procedures are not perfect in distinguishing causation from co-occurrence, creating a situation in which students may be erroneously included in or excluded from the learning disabilities category on the basis of co-occurring conditions. This situation is further complicated because many of the "excluded" conditions are correlated with the lack of development in cognitive and linguistic skills associated with learning disabilities (Fletcher et al., 2002). Chapter 3 discusses these issues in relation to English language learners.

CONSENSUS STATEMENT 6: LEARNING DISABILITIES ARE EVIDENT ACROSS ETHNIC, CULTURAL, LANGUAGE, AND ECONOMIC GROUPS.

Learning disabilities can occur in any cultural or economic group, although the observed prevalence varies across the groups. For example, from ages 6 through 21, American Indian/Alaskan Native students are 1.50 times more likely than other

students, and African-American students are 1.31 times more likely than other students, to receive services for learning disabilities, while white (not Hispanic) students are .88 times as likely to receive services for learning disabilities. However, some students from all racial/ethnic groups receive services for learning disabilities (U.S. Department of Education, 2005). Cross-cultural research suggests that students exhibit characteristics associated with learning disabilities across countries worldwide (Paulesu et al., 2001; Sideridis, 2007). Research on identification of individuals with learning disabilities at the community college level suggests that learning disabilities assessments can be developed that do not result in disproportional representation in terms of race, age, or gender (Mellard, 2003).

Chapter Content, Format, and Considerations

The literature review chapters of this publication are organized into three sections as follows:

SECTION I: ASSESSMENT PRACTICES FOR IDENTIFYING ADULTS WITH LEARNING DISABILITIES

The two chapters in this section examine assessment of adults with learning disabilities from two different perspectives.

Chapter 2, Assessment of Adults With Learning Disabilities: A Quantitative Synthesis of Similarities and Differences, presents results from a meta-analysis that compares the academic, cognitive, and behavioral performance of adults with reading disabilities to that of adults with attention deficit hyperactive disorder (ADHD) and adults with low reading levels and nondiscrepant IQ and reading scores. The chapter identifies characteristics that distinguish individuals with reading disabilities from their non–reading-disabled counterparts based on standardized testing and provides insight into the basic reading, language, and math needs of these individuals.

Chapter 3, Issues in Identifying Learning Disabilities for English Language Learners, presents a range of evidence indicating that current practices in diagnosing learning disabilities in adults who are English language learners places these learners in great jeopardy. Issues of inappropriate diagnostic assessments are counterbalanced by evidence that with appropriate and careful testing there is potential for valid assessment. However, such conditions may not be present in current assessment practices.

SECTION II: EFFECTIVE INTERVENTIONS FOR ADULTS WITH LEARNING DISABILITIES

The chapters in this section reveal the growing research base on accommodations and instruction.

Chapter 4, Accommodations: Evidence-based Accommodation Research Specific to the Adolescent and Adult Population With Learning Disabilities, is particularly important, since "reasonable accommodations" are required by federal laws such as the Rehabilitation Act and the ADAAA. While there is a research base on accommodations that appear to mitigate the effects of learning disabilities in both assessment and instruction, there are many accommodations that, although promising, do not have an evidence base.

Chapter 5, Teaching Methods: Instructional Methods and Arrangements Effective for Adults With Learning Disabilities, provides a research base on the multiple instructional factors that have been shown to impact the literacy outcomes for adults with learning disabilities. This chapter highlights the importance of key instructional variables such as direct and explicit instruction,

practice with feedback, instructional intensity, and promising technology applications.

SECTION III: A DEVELOPMENTAL VIEW OF ADULTS WITH LEARNING DISABILITIES

The chapters in this section present research findings on youth transition and the impact of learning disabilities on adulthood, providing a rich descriptive picture of the potential challenges and successes faced throughout the adult years. The themes of risk and resiliency, self-determination, and support systems are clearly evident across these two chapters.

Chapter 6, Transition and Adults With Learning Disabilities, provides a view of potential needs and services appropriate for adolescents and young adults. Coordination of K–12 information and services and adult services is an important factor during the transition period.

Chapter 7, Impact of Learning Disabilities on Adults, presents a picture of the myriad factors that affect adults with learning disabilities. The importance of self-acceptance and self-understanding as well as services aimed at helping adults with learning disabilities to find their niche are important considerations for any professional working with this population.

Each chapter follows a common format of five major parts.

1. Introduction to the topic highlighting the importance for adult service providers.
2. Description of the literature search process focused on research most relevant to adult education and training programs. This includes search terms, databases, and other sources accessed.
3. View of the research base including quality and quantity of the evidence.
4. Report of findings.
5. Discussion, conclusion, and recommendations.

Research Challenges

The authors faced significant challenges in identifying the research base presented in each chapter. One challenge was the relatively meager body of research in adult education (Comings & Soricone, 2007). Chapter authors had to develop a decision process for including and excluding sources based on specifications that meet current educational research standards (e.g., National Research Council, 2002) while negotiating the breadth and depth of the research base relevant to their topic. Across the chapters, readers will find a range of research methodologies, including randomized experiments, case studies, and survey research.

Chapter information is based to the greatest extent possible on findings from rigorous research, but there is variation among the chapters given the research available on each topic. For example, chapter 2 is a meta-analysis based solely on experimental literature comparing adults with reading disabilities with specific populations of other types of adult readers. Chapter 3 includes a broad array of research on English language learners that crosses K–12, adult, and higher education based on the need to address the relationship between foundational concepts in language learning with assessment practices in diagnosing learning disabilities. In sharp contrast to both these chapters is the limited and methodologically diverse empirical base for chapter 6, the result of limited transition research focused on individuals with LD. Each author describes his/her search strategies and provides an overall view of the strengths and

weaknesses of the evidence base for the findings and recommendations.

The variability in the definition and identification of learning disabilities, examined in depth in chapters 2 and 3, presented other challenges to the researchers. Learning disabilities are "invisible" and highly variable, and research on learning disabilities has suffered in the past from inconsistent definitions and poorly described subject populations. Thus, in research reviews on learning disabilities, including the chapters in this volume, it is important to attend to definitional issues and also to the procedures used for subject selection. In searching for research studies, the authors in this volume used *learning disabilities* as the primary descriptor for the study population, but in some cases also used related terms such as *dyslexia*, *reading disability*, and *dyscalculia* to ensure a broad capture of research. The authors volume were dependent on the original study authors to make valid and consistent identifications of learning disabilities in accordance with established definitions, and to describe their subjects in sufficient detail to allow the study findings to be generalized appropriately. As a means for ensuring that study samples were adequately described, the chapter authors vetted the studies against minimum standards for the description of participants in learning disabilities research (CLD Research Committee, 1993).

Other Considerations

Although the chapters address a cross section of issues important to adult education services for adults with learning disabilities, the following topics are not explicitly included in the research that is reviewed.

Assessment Practices: Screening, Formative, and RTI. Although there are a variety of recommended practices to screen adult learners for possible learning disabilities, there is not a sufficient research base to support a set of valid and reliable practices. Therefore, screening is not addressed in this volume. Formative evaluation is the ongoing collection of information in order to evaluate the effectiveness of instructional implementations and to determine whether adaptations are necessary. There are many specific approaches to formative evaluation, including curriculum-based assessment, curriculum-based measurement, and portfolio and performance assessment (Espin, Shin, & Busch, 2000). Although there is research support for these practices in K–12 education, none of these approaches has a research base for adults with learning disabilities in adult education and training programs. Likewise, RTI is being implemented in K–12 education as a way to provide data to guide instruction and identify students with learning disabilities. Currently, RTI is found only in K–12 education, and its effectiveness is under study (National Joint Committee on Learning Disabilities, 2005).

Neuroscience. Educational neuroscience is an emerging field that integrates research investigating the neural basis of learning with educational practices (National Institute for Literacy, n.d.). Although there is an emerging educational research base related to neuroscience and dyslexia, the direct link to adult intervention practices has yet to be made. This area of investigation is beginning to provide specific guidance for school-age children (Fletcher et al., 2007) and in time, research related to adult education and training programs should be available.

College Students. Learning disabilities are the most highly represented disability designation among college freshmen with disabilities (Ward & Merves, 2006). There is a much more cohesive

and extensive research base on learning disabilities in higher education than in other adult education and training programs. However, findings related to higher education may not always generalize to other adult education and training programs because the context of higher education programs is different from the other programs. For example, higher education settings have application and admissions requirements and often have more organized disability support services than other adult education and training programs. Thus, chapter authors included studies on higher education only when the findings were also relevant to adult education and training programs.

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Chapter 2
Assessment of Adults with Learning Disabilities:
A QUANTITATIVE SYNTHESIS OF SIMILARITIES AND DIFFERENCES

H. Lee Swanson

Introduction

A significant number of adults in the United States demonstrate inadequate basic skills. Approximately 20% to 30% of adults in the United States lack the literacy skills needed to meet the reading and computation demands associated with daily life and work (Lasater & Elliott, 2005). Despite societal trends that demand increased literacy skills, census data indicate that more than 40 million American adults have not attained a high school diploma or its equivalent (Lasater & Elliott, 2005). According to the results of the National Assessment of Adult Literacy (NAAL), a national survey of adult literacy, 11 million Americans are nonliterate in English; 30 million possess Below Basic skills, indicating challenges in reading beyond the most simple and concrete tasks; and 63 million can perform everyday basic literacy activities but have difficulty reading technical information or extended prose (Kutner et al., 2007, p. 2). In addition, 46 million function at the Below Basic level when faced with quantitative literacy tasks (Kutner et al., 2007, p. 35).

About 3 million adults attend a variety of federally funded adult education and training programs designed to target the specific needs of the populations they serve (National Commission on Adult Literacy, 2008). Adults with the lowest literacy levels enroll in adult basic education (ABE) for instruction in reading, writing, and math fundamentals. Some English classes for speakers of other languages also address basic reading and writing as well as conversational English needed for everyday interactions. Many speakers of other languages face the additional challenge of limited literacy skills in their native language that can slow their learning

Incidence of Reading Disabilities

Likewise, it is unclear how many adults suffer from RD. Although there has been no major epidemiological study focusing on RD among adults (Corley & Taymans, 2002), RD has been conservatively estimated as affecting approximately 3%–5% of the general population (National Adult Literacy Survey, 1992). Epidemiological data with children suggest that RD (i.e., dyslexia) fits a dimensional model in which proficient reading and RD occurs along a continuum, with RD representing the lower tail of a normal distribution of reading ability (Gilger, Borki, Smith, DeFries, & Pennington, 1996). Further, longitudinal studies, both prospective (Francis, Shaywitz, Stuebing, Shaywitz, & Fletcher, 1996) and retrospective (Bruck,

1992), indicate that RD is a persistent chronic condition across adulthood. For example in the Connecticut longitudinal project, approximately 70% of children identified with RD in Grade 3 had RD as adults (e.g., Shaywitz et al., 1999). It is important to note that RD (e.g., specific reading disabilities, dyslexia) is a specific form of learning disability that has a biological origin. Several authors indicated that RD is one of the most common neurobehavioral disorders affecting children with a prevalence rate ranging from 5% to 17.5% (e.g., Shaywitz, 1998). Thus, over time and age, proficient readers and those with RD maintain their relative position among the spectrum of reading ability (Shaywitz & Shaywitz, 2003, 2005). Given these assumptions, we assume that approximately 5% of the adult population has RD. The literature characterizes the existence of RD as reflecting problems in accurate and fluent word recognition abilities. The literature also suggests that the difficulties experienced by these individuals are related to deficits within the phonological component of language, which is further unexpected relative to their other cognitive abilities.

ASSESSMENT IN CONTEXT

The primary purpose of assessment is to provide the adult at risk for RD with documentation to access accommodations (see Gregg chapter for review). The typical process would include screening, diagnostic evaluation, and the translation of results to accommodate individual needs. Although extensive guidelines are presented related to expert clinical judgment during the screening process (e.g., www.ahead.org/resources/articles/njcld-paper) and some comparative research is available on adult screening (e.g., Wolff & Lundberg, 2003) and progress has been made in identifying accommodations for adults with LD (e.g., Price, Gerber, & Mulligan, 2003; Westby, 2000), none of the current methods or procedures to determine LD in adults (e.g., discrepancy models) "provide professionals a reliable and valid means of operationalizing the definition of LD for purposes of diagnostic decision making" (Gregg, Coleman, Lindstrom, & Lee, 2007, p. 270). As indicated by Gregg, Coleman, David, Lindstrom, and Hartwig (2006) "accommodation selection should be based on an individual's profile of strengths and weaknesses. The role of specific cognitive and linguistic processing measures is critical to the process of selecting accommodations" (p. 896). Thus, although clinicians must consider multiple data sources that influence an individual's ability to learn, one of the barriers to valid assessment is identifying those cognitive and linguistic processes that separate adults with RD from normal achieving peers.

Issues in the Assessment of Reading Disabilities

Perhaps one of the most contentious aspects concerning the definition of RD relates to establishing a discrepancy between IQ and reading. Since the inception of the field of learning disabilities, the classification of RD has been partly based on the presence of an aptitude (IQ)-reading discrepancy (e.g., Bateman, 1966). That is, the diagnosis and assessment of RD has been based on uncovering a significant discrepancy between achievement in reading and general psychometric intellectual ability (see Hoskyn & Swanson, 2000, for a review of this literature). This discrepancy criterion was included in the federal definition of LD since the development of the U.S. Department of Education's guidance and regulations in 1977 for P.L. 94-142 (1975) and has remained unchanged until recent passage of the Individuals with Disabilities Education Improvement Act of 2004. The concept of unexpected underachievement in students

with LD has been translated into a discrepancy between ability as demonstrated by intelligence testing and achievement measures. However, the recent reauthorization of the Individuals with Disabilities Education Improvement Act of 2004 (IDEIA) has raised validity concerns related to the usability of IQ discrepancy scores in the identification of individuals with RD. With the 2004 enactment IDEIA and the publication of final regulations on August 14, 2006, the federal government recognized potential problems with the IQ-discrepancy method by formally stating that the IQ-achievement discrepancy method was not necessary for LD diagnosis. These policy decisions were partly based on research showing that children with low reading scores and low IQ scores were behaviorally similar to children with high IQ and low reading scores, thus calling into question the discriminant validity of discrepancy scores for identification (e.g., Fletcher, Francis, Rourke, Shaywitz, & Shaywitz, 1992; Fletcher et al., 1994). To facilitate identifying children with LD, three criteria were added to the law (IDEIA 2004), as follows:

1. States are not required to use a severe discrepancy between intellectual ability and achievement.
2. The procedure must include a process whereby the children's response to scientifically based research interventions is considered in the assessment process.
3. States are permitted to use alternative research-based procedures to determine a specific learning disability (i.e., RD).

The current alternative to the discrepancy model is response to instruction (RTI). The goal of RTI is to monitor the intensity of instruction and make systematic changes in the instructional context as a function of a student's overt performance. This is done by considering various tiers of instructional intensity, and assessment information is gained through a systematic manipulation of the environmental context (i.e., instruction, classroom, and school) to determine procedures that maximize learning. IDEIA 2004's support for an RTI alternative to the IQ-achievement discrepancy model for LD identification is problematic, given RTI's lack of strong empirical support as an identification model (Fuchs, Mock, Morgan, & Young, 2003). At the time of this writing, no controlled studies randomly assigning children (or adults) at risk for RD to assessment and/or delivery models (e.g., tiered instruction vs. special education [resource room placement]) have measured outcomes on key variables (e.g., overidentification, stability of classification, academic and cognitive growth in response to treatment). The few studies that compare RTI with other assessment models (e.g., discrepancy-based or low achievement–based models) involve post hoc assessments of participants divided into subgroups at post-test as responders and nonresponders within the same sample. In addition, different states and school districts have variations in their interpretations on how RTI should be implemented, thereby weakening uniformity (i.e., reliability) in the assessment of RD.

Although the reliability and validity of RTI models (or alternative models, e.g., dynamic assessment) as a means to assess RD in children has a limited database, the critical issues related to the reauthorization of IDEA in 2004 (IDEIA) have application to defining adults with RD. The reason is that the role of IQ and achievement discrepancies remains an important component of eligibility models for adults with RD. For example, the *Diagnostic and Statistical Manual of Mental Disorders*, fourth edition, text revision (*DSM-IV-TR*) (American Psychiatric Association, 2000) lists a discrepancy as the first criterion in establishing a learning disorder (e.g., reading disorder). That is, the academic skill in question (e.g., reading), as measured by individually administered standardized tests, is substantially below expected performance when commensurate with age, measured intelligence, and educational history.

The validity of this model has not been scrutinized with adults as it has with children. This is unfortunate because a perusal of the literature on the definition of adults with RD using discrepancy criteria has been litigious (e.g., *Guckenberger vs. Boston University*; see Siegel, 1999, for a review). Therefore, some of the issues raised with defining RD in children needs to be investigated with adults.

Key Issues in Validating Definitions of RD

Although there are operational definitions of individuals with RD provided by researchers that do not rely on discrepancy criteria (e.g., cutoff scores for determining RD on various measures—e.g., Siegel & Ryan, 1989; Swanson, 1991), there are two issues that limit consensus on defining individuals with RD. One is related to the role of IQ in the assessment process, and the other is related to whether the cognitive processes that underlie RD are distinct from other poor-reading groups.

INTELLIGENCE

The implicit assumption for the inclusion of discrepancy scores in the classification of RD is that individuals who experience reading difficulties, unaccompanied by a low IQ, are distinct in cognitive processing from other low-achieving groups (otherwise referred to as low-achieving, garden-variety readers, and nondiscrepancy groups). However, this assumption has been debated for some time (see Aaron, 1997, for review). For example, some studies that compare children with discrepancies between IQ and reading with nondiscrepancy-defined poor achievers (i.e., children whose IQ scores are in the same low range as their reading scores) find that these groups are more similar in processing difficulties than different (Fletcher et al., 1992; Stanovich & Siegel, 1994). Although some researchers report qualitative, specific differences in reading or cognitive subskills (Aaron, 1991), others indicate that the underlying cognitive processes of both groups are similar (Aaron, 1997; Fletcher et al., 1992; Stanovich, 1991). As a result, several researchers have advocated abandoning the concept of RD, or at least the requirement of average intelligence, in favor of a view where individuals with reading problems are best conceptualized as existing at the extreme end of a continuum from poor to good readers (Fletcher et al., 1994; Stanovich & Siegel, 1994). Some argue that IQ is irrelevant to the definition of RD and that poor readers share cognitive deficits, irrespective of general cognitive abilities (Siegel, 1993).

In essence, several authors have argued that variations in IQ tell us little about differences in processing when groups are defined at low levels of reading (e.g., Francis et al., 2005). However, are variations in IQ and reading really irrelevant to the assessment of RD? Consider three meta-analyses on this contentious issue prior to the passing of IDEIA in 2004 (Fuchs, Fuchs ,Mathes, , & Lipsey, 2000**;** Hoskyn & Swanson, 2000; Stuebing et al., 2002). The commonalities and contradictions in these three meta-analyses are reviewed in Stuebing et al. (2002). Stuebing et al. considered the Hoskyn and Swanson (2000) selection process of studies to be the more conservative of the three and, therefore, these findings will be highlighted. The Hoskyn and Swanson (2000) meta-analysis analyzed only published literature comparing children who are poor readers (i.e., word recognition scores below the 25th percentile), but either had higher IQ scores than their reading scores or had IQ scores commensurate with their reading scores. Although Hoskyn and Swanson's synthesis found similarities on various measures among the discrepancy and nondiscrepancy

groups, the regression analysis showed that verbal IQ significantly *moderated* the magnitude of effect sizes.[1] That is, verbal IQ affected the *direction* and *strength* of the effect size difference between the two groups. The higher the verbal IQ for the RD group relative to the low achiever, the greater the chances their overall performance on cognitive measures would differ from the low achiever. In short, verbal IQ was relevant to the magnitude of cognitive differences between the groups.

In contrast, the Stuebing et al. (2002) meta-analysis concluded that IQ was irrelevant in explaining cognitive and related processing differences between children with RD (high IQ-low reading) and poor readers (low IQ-low reading). However, as shown in their results (see table 6), IQ accounted for a substantial amount of the explainable variance in reading (e.g., real-word decoding, reading comprehension, and explainable variance ranged from approximately .25 to .40). This certainly does not suggest that IQ is completely irrelevant to reading level. Significant differences on cognitive measures between the two groups were also found in a large meta-analysis by Fuchs et al. (2000). Fuchs et al. (2000, p. 94) compared low-achieving children with and without RD, and found moderate effect sizes (mean = .61) in favor of low achievers without RD. In conclusion, these syntheses suggested that removing IQ as an aptitude measure in classifying children as RD, especially verbal IQ, from assessment procedures was not uniformly supported. The question emerges, however, as to whether variations in IQ moderate performance differences in adults with RD when compared to poor-reading adults whose IQs are in the same low range as their reading scores.

DEFICIENT READING AND COGNITIVE PROCESSES

The second major issue is whether the same processes that underlie poor reading performance in children are similar to the processes that underlie poor reading performance in adults. As with children, there is evidence that adults with RD experience deficits in single-word recognition (e.g., Bruck, 1990; Scarborough, 1983). As with children, they remain impaired on processes that underlie word recognition abilities, such as phonological processing (Bruck, 1990, 1992, 1993; however, see Snowling, Bishop, & Stothard, 2000) and rapid automatized naming (Decker, 1989; Felton, Naylor, & Wood, 1990). Furthermore, phonological skills, as measured by nonword reading, are poorer than expected for their age and also for their level of single-word recognition skill (Bruck, 1992). These findings are consistent with those suggesting that among samples of normal adult readers, one of the best predictors of reading comprehension is word recognition skill (Cunningham, Stanovich, & Wilson, 1990). However, some studies suggest a weak association between word recognition skills and reading comprehension for adults with RD (Bruck, 1990; Conners & Olson, 1990). For example, Bruck (1990) found that some adults with childhood dyslexia achieved age-appropriate scores on standardized reading comprehension subtests. These scores were in the same range (i.e., sixth grade to adult) as Scarborough's (1983) sample of adults with self-reported childhood dyslexia. Lefly and Pennington (1991) estimated that approximately 25% of adults with childhood reading difficulties reach the adult years with *no* obvious evidence of reading comprehension problems. That is, some adults with RD in their sample achieved comprehension of text scores comparable to average adult readers matched on chronological age. A similar dissociation of word recognition skill and reading comprehension has also been noted in a sample of adolescents with dyslexia (Conners & Olson, 1990). Thus, it is possible that difficulties in reading and reading-related behavior in some adults with RD are reliably predicted from word recognition skills, whereas in others they are not. Further, some studies suggest that phonological skills wane in importance for normal readers beyond

the elementary years (e.g., Scarborough, Ehri, Olson, & Fowler, 1998), and this may also be the case in individuals with RD in adulthood.

In general, the literature is unclear as to whether adults with RD reflect a set of cognitive deficits similar to children with RD, and/or whether the cognitive deficits of adults with RD can be discriminated from other poor-reading adults who have IQ scores in the same range as their low reading scores. Assuming that RD is stable throughout adulthood, some of the same patterns found with children may emerge in adults, suggesting that one cannot clearly identify adults with RD from those who are generally low achievers. In addition, the literature is unclear as to whether reading failure for adults with RD reflects a set of cognitive processes specific to reading, or whether deficits affecting reading extend into other domains, such as mathematics, writing, spelling, and reasoning skills. There are a number of reasons why it may be difficult to identify the major processing difficulties of adults with RD. Four are considered below.

One reason is that the operational criteria and measures in the selection of RD participants among studies vary. For instance, IQ-achievement discrepancies that define RD groups can range from a difference of .5 to 2.0 standard deviations in various studies. Although it has been argued that the degree of discrepancy between IQ and reading is not meaningful (e.g., Siegel, 1992; Stanovich, 1991), such variations have not been tested in adult samples. A second reason is related to sample selection. For example, at least two methodological procedures may create difficulties in generalizing findings as a function of the sample selection: (1) Cutoff and regression-based definitions do not necessarily yield similar results (Fletcher et al., 1992), and (2) IQ tests generate subtest and general ability scores, each of which results in the selection of different study samples. Earlier, Stanovich (1988) also suggested that when findings of comparison studies are evaluated, it is necessary to examine the level of reading upon which the sample is matched because word recognition and comprehension strategies are regulated by different cognitive systems. A third reason relates to the age of the sample. Although phonological processing deficits are common to children with RD in the early stages of reading, these problems may not extend into adulthood (Bruck, 1992). A final reason it may be difficult to determine unique cognitive disabilities in adults with RD is because of variations in the type of IQ test (e.g., verbal, performance) used. The use of different measures of IQ (e.g., verbal, performance, full-scale) to select groups in comparison studies will result in the identification of different subgroups of individuals with RD which, in turn, alters the type of cognitive deficit observed. In earlier research, Stanovich (1991) suggested the use of the *verbal* IQ as a discrepancy measure by reasoning that because the relation between verbal IQ and reading is robust, in situations where the verbal scale is allowed to be below that of the poor-reader control group, broad-based verbal deficits will obscure identification of more circumscribed processing deficits.

Research Questions

The purpose of this chapter is to synthesize the empirical literature comparing adults with RD and adults without reading disabilities across an array of intellectual, academic, cognitive, vocational, and life-adjustment measures. Because this chapter focuses on empirical comparative studies, a quantitative synthesis, referred to as a meta-analysis, will be used to synthesize the literature. *Meta-analysis* refers to a statistical technique used to synthesize data from separate comparable studies in order to obtain a quantitative

summary of research that addresses a common question (Hedges & Olkin, 1985). The *d-index* by Cohen (1988), commonly used to make comparisons, is a scale-free measure of the separation between two group means that is used when one variable in the comparison is dichotomous (e.g., adults with RD vs. without RD) and the other is continuous (e.g., vocabulary performance). To make *d*'s interpretable, statisticians have adopted Cohen's (1988) system for classifying *d*'s in terms of their size (i.e., .00–.19 is described as trivial; .20–.49, small; .50–.79, moderate; .80 or higher, large).

In order to differentiate assessment practices for identifying adults with RD from those adults without RD, three questions directed this synthesis:

1. What domains of performance (i.e., intellectual, academic, cognitive, vocational, and life-adjustment) clearly differentiate adults with RD from average-achieving counterparts, as well as adults with ADHD, and adults with RD but with low IQ scores? The practical application is to show the similarities and differences between groups in terms of magnitude of effect sizes across an array of measures.
2. What performance similarities or differences among adults with and without RD are a function of variations in age, ethnicity, and gender? For example, we determine if some of the same deficits (as reflected in the magnitude of effect size) that emerge in studies that include older participants with RD also occur when the sample is of college age.
3. What performance differences emerge in adults with RD when compared to their counterparts as a function of cutoff score criteria? We compare studies on performance outcomes as a function of severity of the reading disability and intelligence level.

To answer these questions, the present synthesis calculated effect sizes across studies to determine those processes that separate adults with RD from proficient readers matched on chronological age. We assume that those processes at or above .80 in terms of effect size would be considered critical areas in the assessment of adults with RD relative to skilled readers. The present synthesis also extends the literature on the assessment of adults with RD in two major ways. First, beyond discussing outcomes related to the magnitude of effect sizes, we use a hierarchical linear modeling (HLM) procedure to identify key constructs (e.g., IQ, reading, math, memory, phonological processing) that contribute unique (independent) variance to defining differences and similarities between adults with and without RD. Second, direct comparisons are made across studies in terms of variations in IQ and reading level. For example, we assess the relevance of IQ in predicting overall performance when variation in reading and other processes are taken into consideration. Thus, studies that show large variations (i.e., discrepancies) in IQ and reading are compared to those that show minimal discrepancies. Of interest is whether effect sizes vary between adults with reading and IQ scores in the same low range when compared to studies that included samples with IQ scores substantially higher than reading scores.

METHODS

Identification of Studies (Literature Search)

Data gathering. Several approaches were used to locate the relevant studies published in peer-reviewed journals. First, a computer search located studies comparing adults with reading disabilities and without reading disabilities on psychological, occupational, and vocational variables using the PsycINFO, Medline, and ERIC databases. The computer search used the following terms: *adults, adult, students, college students*, coupled with *learning disabilities, dyslexia, reading disabilities, reading disorders, specific reading disabilities, math disabilities,* and *dyscalculia*. Entry of these terms yielded 9,733 references. Additional terms were entered into the search, such as *IQ* and *assessment*, but they overlapped

with the earlier terms. A refinement of the search focused only on empirical studies and journal articles published in English. The sample search obtained articles using the above descriptors that range in publication date between 1963 and September 2007. Second, published articles by primary researchers (i.e., Gerber, Vogel, Siegel, Hoy, Reiff, Shaw, McGuire, Shaywitz, Newman, Seigel, Houck, Gregg, and Pennington) were also analyzed for possible inclusion. Finally, a manual search was conducted of journals where the majority of articles were published (e.g., *Journal of Learning Disabilities*, *Learning Disabilities Research & Practice, Annals of Dyslexia, Learning Disability Quarterly*). From this pool of literature, articles were eliminated that focused on adults with below-average intelligence (mild mental retardation range) and/or were not comparative (data-based) studies.

Focusing on comparative studies (adults with RD vs. adults without RD) published in English journals narrowed the search down to 450 studies. The 450 "potential studies" were further evaluated to determine their relevance to the current review. To be included in the meta-analysis, each study had to satisfy the following criteria:

1. An adult group with RD (e.g., reading disabilities, dyslexia, specific learning disabilities in reading) was compared to an adult group without RD (i.e., no indication of a learning or behavior deficit). Other comparison groups (e.g., adults with ADHD) were coded only if an average-achieving group was included in the sampling.
2. Within the RD groups, at least one RD subgroup has no reported comorbidity (e.g., math disabilities, ADHD).
3. Each study reported a mean score on a standardized (norm-referenced) measure of intelligence for each comparison group (e.g., Wechsler tests or selected subtests).
4. Each study reported a mean score from a standardized reading test for each comparison group.
5. The sample size of adults with RD in the study was greater than 9; this eliminated single-subject design studies and case studies.

Studies were excluded if (a) they were not published in refereed journals, (b) they failed to provide enough quantitative data to calculate the effect sizes (ESs), (c) they failed to include a chronologically age-matched average-achieving comparison group, and/or (d) they failed to provide information on ability-group performance on a standardized (norm-referenced) reading and/or IQ test. Some studies did not report standard deviations for the classification measures (IQ and reading), but because mean scores were reported, they were included in the analysis. Based on the above criteria, 52 articles were included in the synthesis.[2]

CODING PROCEDURE

Each study was coded for the following information: (a) sample characteristics, (b) classification measures, and (c) performance measures.

Attributes of the study. Each study provided (a) the year of the study, (b) the name of the first author, (c) the number of coauthors, and (d) the country where the study was carried out.

Attributes of the participants. According to the inclusion criteria, each study provided at least one RD and one non-RD (NRD) comparison group. Other attributes of the participants coded included (a) the number of participants in each subgroup, (b) the number of males in each subgroup, (c) the mean age of the group (converted into months), and (d) participants' primary language. Studies were also coded for (e) socioeconomic status (SES) and (f) ethnicity.

Comparison measures. All classification measures (i.e., IQ, reading, and math) were converted to standard scores. In those cases in which only a range was reported, a middle value was assigned. Classification measures included measures of general intelligence (performance and nonverbal), reading recognition,

and reading comprehension. Comparative measures (those not included as part of the classification criteria—i.e., general intelligence and reading scores) were organized into several categories: verbal intelligence, naming speed, phonological processing, word attack, math, vocabulary and language, spelling, writing, social skills, problem solving and reasoning, memory and cognitive monitoring, perceptual motor skills, visual perception skills, auditory perception skills, general information/facts, personality, and brain or neuropsychological measures (e.g., electroencephalograms [EEGs]).

Because of the small number of ESs, some of the above categories were aggregated into broader domains. For example, measures of rapid naming of objects, letters, and numbers were included under the category of naming speed. The visual-spatial category included measures of both visual-motor and non–visual-motor tasks. Although comparative tasks not used in the classification criteria were used in calculating effect sizes, some of the categories for analysis were no doubt closely related (e.g., word attack) to the classification variable (i.e., word recognition). Thus, adults with RD were compared to their counterparts on measures related to the following categories:

CLASSIFICATION MEASURES

1. *Real-Word Reading*. This category focused on the sight recognition of real words. Sample tasks include measures of irregular and regular words, experimental words, and real-word identification (e.g., WRMT-word identification, Wide Range Achievement Test-reading subtest [WRAT-R]).
2. *Reading Comprehension*. This category focused on measures of text or passage comprehension. The majority of dependent measures in this domain included reading comprehension and general reading measures (e.g., Woodcock-Johnson Psychoeducational Battery [WJPB]-reading cluster, Nelson Denny, verbal Scholastic Assessment Test [SAT]).
3. *General Intelligence*. This category focused on standardized measures taken from tests of general intelligence. Sample tasks included Raven Progressive Matrices test, full-scale IQ (subtests of vocabulary, block design, digit span, and verbal IQ, taken from standardized intelligence tests, were assigned to the categories belowe.g., vocabulary, reasoning, verbal memory, verbal IQ]).
4. *Verbal Intelligence*. This domain included general measures of verbal intelligence (e.g., Wechsler Adult Intelligence Scale [WAIS]-verbal IQ)

COMPARATIVE MEASURES

5. *Phonological Awareness*. This category focused on oral tasks that required dividing spoken words into segments of sounds smaller than a syllable or learning about individual phonemes (Torgesen & Mathes, 2000). Sample tasks included spoonerisms, blending sounds, naming letter sounds, phoneme deletion, phoneme elision, phoneme segmentation, phonemic blending, phonological awareness, phonological oddity, phonological skills, rhyme, rhyme judgment, rhyming letter naming, word analysis), sound categorization, syllable deletion, phoneme detection).
6. *Naming Speed*. This category focused on measures of speed (timed trials) related to the overt verbalizing of letters, sounds, words, objects, or colors. Sample tasks included color naming, digit naming, picture naming, number naming, letter naming, object naming, and naming of words (e.g., nonwords, regular words, pseudowords).
7. *Pseudoword Reading (Word Attack)*. This category focused on measures of word attack skills and was considered as a separate entity of phonological processing. These tasks required the reading of printed nonwords. This category fits most closely with the definition provided by Siegel (1993) that phonological processing is "the understanding of the grapheme-phonological conversion rules and the exceptions to these rules" (p. 38). Sample tasks

included the reading of nonwords (pseudowords) or sounding out of nonwords of increasing complexity from the WRMT-R.

8. *Math*. This category focused on measures related to calculation. Sample tasks included measures of arithmetical calculation and word-problem solving (e.g., WRAT, Peabody Individual Achievement Test [PIAT], WJPB-math cluster), and SAT math.
9. *Vocabulary*. This category focused on measures related to word meaning. Sample tasks included measures of word knowledge, semantic processing measures (Peabody Vocabulary Test, WAIS-vocabulary), and the Stanford Binet Vocabulary Test.
10. *Spelling*. This category focused on real-word spelling skills. Sample tasks included spelling subtests taken from standardized tests (e.g., WRAT, Iowa Test of Basic Skills [ITBS]).
11. *Writing*. This category focused on written language (WJPB-written language cluster) and included measures of syntax and grammar (Test of Adolescent Language [TOAL]).
12. *Social Awareness*. The category focused on measures of help seeking, self-perception, perceived social support, and social competence.
13. *Problem Solving/Reasoning*. This category focused on general problem solving on measures assumed to measure fluid intelligence (e.g., critical thinking, block design, picture arrangement, and WJPB-cognitive cluster).
14. *Memory and Cognitive Monitoring*. This category focused on span measures related to digits, words, sentences, and objects. Some tasks were considered measures of cognitive monitoring, such as the Tower of Hanoi, trail making. Phonetic (phonemic) memory (recall of isolated sounds) was coded as a measure of phonological awareness and, therefore, was not included in this category. This category was subdivided into verbal memory, visual-spatial memory, and cognitive monitoring.
15. *Perception and Motor Tasks*. This category focused on measures of tactical performance balance.
16. *Visual Perception*. This category was visual-perceptual motor tasks.
17. *Auditory Perception*. This category was auditory-perceptual motor or listening tasks.
18. *General Information*. This domain included measures that tapped previous knowledge or memory for general information (e.g., WAIS-information subtest, WJPB-knowledge cluster, and questions such as "What is the capital of California?").
19. *External Criteria—School and Work*. This domain included measures provided by professors, teachers (e.g., grades), and/or employers related to resource management and work performance.
20. *Personality*. This domain included measures of personality (Minnesota Multiphasic Personality Inventory [MMPI]).
21. *Brain and Neurological Measures*. This domain primarily included measures of EEG function.

See appendix A at the end of this chapter for information on calculation of effective sizes, statistical analysis, and interrater agreement.

Findings

Specific findings from the meta-analysis are described in appendix B of this chapter.

Discussion

This discussion is based on the results of the quantitative synthesis of the published literature comparing adults with RD with chronologically age-matched average readers (contained in appendix B). Also included in the comparisons were samples of adults with ADHD. Prior to reviewing our findings and making applications to assessment, we addressed the three specific purposes of the synthesis.

First, we sought to determine whether the deficits in adults with RD were distinct from their average-achieving counterparts, as well as from adults with ADHD and studies that have samples with RD but with low IQ scores. As expected, adults with RD varied substantially from adults without RD on the classification measures (i.e., M = 1.20 reading comprehension, M = 1.37 reading recognition, .63 verbal intelligence). More important, the results on the comparative measures (i.e., those not used as part of the classification criteria) yielded moderate to high (.50 to 1.33) ESs in favor of adults without RD on measures of naming speed (M = .96), word attack (1.33), math (M = .75), vocabulary (M = .71), spelling (M = 1.57), writing (M = .72), general information (M = .47), and verbal memory (M = .62). Low to moderate ESs emerged on measures of general intelligence (M = .20), problem solving/reasoning (M = .11), visual memory (M = -.39), monitoring-executive processing (M = .27), perceptual skills (M = -.13), personality (M = .28), and neuropsychological indices (M = -.02).

Adults with ADHD also outperformed adults with RD on measures of reading comprehension (M = .62), verbal intelligence (M = .41), word attack (M = .53), and verbal memory (M = .44). An advantage was found for adults with RD relative to adults with ADHD on measures of naming speed (M = -.82) and problem solving/reasoning (M = -.83).

Second, we sought to determine whether the deficits in adults with RD relative to average readers were a function of age. An analysis of the influence of age was done to determine whether the magnitude of differences between RD and average-achieving adults persisted across different age levels. The results of the hierarchical linear modeling clearly indicated that age, as well as gender ratio, was unrelated to the magnitude of ESs when the influences of all other classification variables were partialed out in the analysis. This finding emerged even when the categorical domains related to the type of measure (e.g., phonological processing), IQ, reading, math, and related achievement measures were partialed out of the analysis. Thus, the results support the notion that reading achievement and cognitive deficits in RD are persistent across age. As found with children, deficits in phonological processing, naming speed, and verbal memory continue to characterize RD even in adulthood. Performance on phonological processing measures was a discriminating variable between adults with RD and average adult readers. This is not to suggest that adults do not become proficient in some areas of reading (as found in some studies), but the majority of studies found that adults with RD still exhibit poor phonological processing and reading relative to average-achieving readers. The results are consistent with earlier studies on adults with RD showing that the reading of familiar words is usually slower and less accurate or automatic when compared to average-reading peers (Bruck, 1992, 1993). From a clinical perspective, the ES data show that adults with RD may learn to read words accurately in some studies, but they may have lingering problems related to a phonological deficit.

The final question addressed whether the ESs varied as a function of severity in RD and intellectual level. The key finding on this issue was that variations in the level of intelligence significantly moderated effect sizes between adults with RD and without RD. We did not find, however, that a large

disparity between level of IQ and the level of reading (as reflected in the aggregated scores between studies) interacted with the magnitude of effect sizes. Only the main effect of IQ played a significant moderating role in the outcomes. In general, we found that when studies were divided into those with high- and low-IQ levels, studies with low-IQ participants yielded *lower* effect sizes between adults with and without RD on measures of cognition and language than those with relatively high IQs. Thus, variations in IQ clearly moderated outcomes related to effect sizes. Interestingly, we did not find that the level of RD (moderate vs. severe) moderated outcomes related to cognition and language.

A further analysis of studies showed high-IQ samples with RD were more likely to yield comparable standardized math scores to adults without RD, although they suffered greater deficits relative to average readers on measures of phonological processing and verbal memory when compared to studies that included lower-IQ samples. The results are consistent with the notion that as intelligence scores increase among adults with RD, their language and cognitive processing deficits becomes more pronounced (discriminating) relative to skilled readers.

ISSUE RELATED TO CLASSIFICATION

What are the implications of our findings to definitional and assessment issues in measuring and assessing reading problems in adults with RD? There are at least three implications related to assessment and measurement of performance in adults with RD.

1. We found clear support for the inclusion of cognitive processing measures as a valid component in the assessment of adults with RD. Clear weaknesses in processing emerged on measures of rapid naming, phonological processing, and verbal memory. Further, adults with RD were clearly differentiated from adults with ADHD on measures of verbal memory.

It has generally been presumed that adults with RD experience difficulties in reading recognition because they have a low degree of phonological awareness. This appears to be the case in the present meta-analysis. However, we found that other processes (e.g., rapid naming, verbal memory), independent of phonological awareness, were related to differences between adults with and without RD. Why is this the case? One possibility is that phonological skills are no more important in adult samples than are other verbal processes. A similar observation has been made by Scarborough et al. (1998) when they stated, "what the adolescent and adult data indicate… is that phonemic awareness may not always be necessary for successful reading acquisition. Instead, some individuals may never come to appreciate the existence of phonemes and yet may attain high levels of achievement" (p. 139). Our results are consistent with those of Scarborough and colleagues, suggesting that phonological awareness may be no more important than other processes in accounting for differences between adults with and without RD.

No doubt, the above finding creates a conceptual problem when one attempts to link RD in adults to a specific or core phonological processing deficit. Perhaps one obvious means of reconciling this conceptual problem is to suggest that relationships among cognitive processes reflect "bootstrapping effects" (see Stanovich, 1986, p. 364, for a discussion of this concept). As stated by Stanovich (1986), "Many things that facilitate further growth in reading...general knowledge, vocabulary...are developed by reading itself" (p. 364). Thus, due to the mutual facilitation between reading and cognitive processing, such interrelationships would be expected to increase with skill improvement. The implicit assumption, however, is that the deficits in word recognition skills (e.g., phonological skills) underlie such bootstrapping effects. Our hesitation in accepting this assumption, based on studies in the current synthesis, is that differences emerge on vocabulary, rapid naming, and verbal

memory even when reading recognition, reading comprehension, phonological processing, and word attack were partialed from the analysis.

Another means of reconciling the phonological core issue is to suggest that high-order cognitive processing problems can exist in adults with RD *independent* of their specific problems in low-order processes, such as phonological processing. Thus, adults with RD may be viewed as having difficulty accessing high-level information (as reflected in their reading comprehension and vocabulary scores) and/or lower-order skills (phonological codes), or switching between the two levels of processing. Difficulties in coordinating multiple pieces of information have been applied to various information processing models of RD (Swanson & Alexander, 1997). Thus, one may speculate that the processing problems in adults with RD reflect a system that fails to compensate for (or effectively coordinate) deficiencies in lower-order specialized processes. This lack of compensatory processing may be characterized by a processing system either not contributing enough information to a specialized system or failing to provide an adequate capacity of processing resources (i.e., because of verbal memory deficiencies), given that there are problems in a specialized system. Future research will have to focus on the interaction between higher- and lower-order processing during the act of reading to disentangle these issues.

2. *We found clear support for the notion that verbal IQ is a valid component in the assessment of RD.* Several researchers have suggested eliminating IQ from the classification of RD (e.g., Siegel, 1992). We find, however, that although the "degree" or "direction" of the discrepancy between IQ and reading was not supported in predicting ESs (i.e., no interaction emerged), the results do support the notion that verbal IQ be included as part of the assessment process. We find that verbal IQ significantly moderated ES differences across a broad array of measures. More important, the HLM analysis showed that (a) variations in reading did not partial out the influence of verbal IQ in predicting differences between adults with and without RD, and (b) variations in reading (whether word recognition or reading comprehension) did not eliminate the contribution of cognitive variables in accounting for ES differences between adults with and without RD. The results of the HLM analysis showed that the unique variables in assessment process were measures of verbal IQ, reading (both word recognition and comprehension), phonological processing, naming speed, word attack, math, vocabulary, spelling, and verbal memory. These variables were significant moderators and independently contributed to discriminating the differences between adults with and without RD when the influence of all other variables was entered into the analysis. Thus, the results are consistent with assessment models emphasizing verbal IQ, word recognition, reading comprehension, math, spelling, and cognitive (e.g., phonological, naming speed, verbal memory) measures in the assessment of RD.

3. *Among poor readers, tentative support was found for the use of cutoff scores in IQ rather than cutoff scores in reading severity as a valid model for determining RD.* Among studies with low reading scores (< 25th percentile), those that reported high IQ scores relative to their reading scores were "worse off" on measures of cognition and language relative to normal controls than those studies that reported IQ scores roughly in the same range as their reading scores. We say "tentative support" because (1) high vs. low IQ and high vs. low reading did not significantly interact when predicting variations in cognitive and language skills, and (2) the magnitude of the differences was indirect (nondiscrepant and discrepant groups were compared to average achievers, not to each other). Thus, perhaps the most critical finding of this synthesis with implications for assessment is that extremes between reading and IQ (i.e., the degree of discrepancy between

IQ and reading) in the adults with RD sample were not a significant predictor of ES estimates of cognitive and language performance. Instead, the critical factor in assessment was that the higher the IQ in adult samples with RD (IQs > 100), the poorer their performance was relative to skilled readers. Before we discuss the implications of this finding, however, we consider some of the caveats related to our synthesis.

First, it is important to note that in this synthesis, we selected studies that classified adults with RD performing at various levels on either a word recognition and/or reading comprehension continuum. Each of these measures draws upon different processes, which may have obscured the results. Likewise, some studies utilizing adults with RD were based on childhood diagnosis, and some of the adult reading scores were in the low to average range. To address these variations, we divided studies as yielding severe or moderate RD based on the 25th percentile of the aggregated word recognition and/or reading comprehension scores. (Some studies reported only one measure and therefore only one score could be used.) The 25th percentile is a common cutoff score in the literature for subtyping reading disabilities from other academic difficulties. We also selected studies that defined the adult RD group as having general intelligence scores above 80. Although our separation of studies by reported IQ and reading scores did not validate a discrepancy model that focused on the differences between IQ and reading, our quantitative review of the literature did allow us to develop an assessment profile of adults with LD by "cutoff scores." This separation clearly identified those areas in which adults with reading disabilities differ from their peers—thus, discriminant validity was established.

It is important to note in our studies that one of the most frequent identifiers of adults with RD provided by the primary authors was an existing discrepancy between the targeted sample's IQ and his or her current reading achievement. However, our use of aggregated scores related to IQ and reading and our sorting of studies by cutoff criteria may not reflect variables that underlie how subjects were selected in the first place. For example, we relied on standardized reading scores as a means of sorting studies for analysis, but some of the studies included groups with a broad array of academic difficulties, of which reading was only one.

The second caveat is that finding no significant IQ x reading interaction on various cognitive measures does not imply high- and low-discrepancy adults with RD process information the same. Previous studies have shown that individuals with RD may be statistically comparable to various ability groups, but they display qualitatively different cognitive representations (see Swanson, 1988, 1993, for a review).

The third caveat was that although we selected studies that included only samples with at least one IQ score above 80 in the analysis, no cap was placed on the upper limits of IQ scores. Some studies had high mean IQ scores (e.g., M = 123) that fell within a level that might be referred to as "high," and therefore, these adults experienced *more specific* deficits in cognitive and language areas than adults closer to an IQ of 80. It is possible that if the parameters for defining the nondiscrepancy groups focused on higher- and lower-IQ groups, as well as different types of IQ measures (e.g., nonverbal, performance), different outcomes may have emerged.

The final issue was that our selection of studies was biased toward including only those that included samples with designated labels of RD (or a related term) as well as samples that had reported both intelligence and reading scores. Given these restrictions, however, this synthesis supports previous syntheses showing that IQ is important in predicting effect size differences across language, behavioral, and cognitive variables (Fuchs et al., 2000; Hoskyn & Swanson, 2000).

Given the above caveats, how does one assess academic, language, and cognitive performance of adults with RD? The question is critical because defining RD by discrepancy criteria is one of the fundamental

ways of classifying adults with RD. In addition, this is a difficult question to answer because our synthesis concurs with several individual studies indicating that the degree of discrepancy between IQ and reading was not an important predictor of cognitive and language effect sizes (Hoskyn & Swanson, 2000; Stuebing et al., 2002). The most obvious answer to the above question is to simply abandon the use of discrepancy criteria that relies on difference scores (i.e., relying on extreme differences between IQ and reading) and instead rely on cutoff scores for defining RD samples. For example, our synthesis suggests that high-discriminant validity emerges across an array of cognitive measures when adults with IQs above 100, math scores in the average range, and reading scores below the 25th percentile are selected for study. However, we think our conclusion related to IQ and reading discrepancies may still be premature. Several assumptions have to be met in validating the usefulness of potential-achievement discrepancies in the identification of adults with RD (or learning disabilities). These assumptions are as follows:

1. *Intervention*. It is important to determine whether a discrepancy in IQ and reading is consequential in performance outcomes in adults with RD. A critical assumption in testing the discrepancy model is that differences in the direction of the profiles are important. The fact that Adult A has a relatively high reading score, but low intelligence score, should reflect a different "set of" or "level of" processes when compared to Adult B with a high IQ score but low reading score. A major assumption in variable selection for classification purposes is that the direction of the discrepancy is theoretically consequential. For example, even though phonological processing is comparable between high-IQ adults with RD and low-IQ poor readers, it is not necessarily the case that low-IQ high readers have better phonological processing skills.

The most obvious test of the importance of variations in IQ and reading among adults with RD is to test whether such variations are related to treatment outcomes. Responsiveness to instruction seems to be a missing test in the majority of studies focusing on adults with RD. In terms of children with RD, some studies have found very little relevance related to IQ levels within studies of treatment outcomes (e.g., Vellutino, Scanlon, & Lyon, 2000). However, there is no synthesis on these issues with adults. To validate a discrepancy model, it will be necessary to determine if variations in how samples with RD are defined in terms of intelligence and reading have any relationship to treatment outcomes. It would seem that efforts to completely disband IQ measures in assessing adults' response to instruction would be premature if adults high and low in IQ respond differently (quantitatively or qualitatively) as a function of treatment.

In reviewing the intervention literature on children with RD, Swanson, Hoskyn, and Lee (1999) found that significant IQ x RD treatment interactions exist across evidence-based studies (also see Swanson & Hoskyn, 1999, for review). They found that study variations in IQ and reading level were important moderators of instructional outcomes in both group design (Swanson & Hoskyn, 1998, 1999) and single-subject design studies (Swanson & Sachse-Lee, 2000). The effect sizes (in this case, children with RD in the experimental condition were compared to children with RD in the control condition) were moderate (.52) when intelligence was above 90, but substantial (.95) when IQs were below 90. That is, the closer the IQ score is to the low reading score (< 25th percentile), the more responsive is the sample to intervention. A follow-up of these results has also found that adolescent samples with discrepancies in intelligence and reading were more likely to yield lower effect sizes in treatment outcomes than those studies that report aggregated IQ and reading scores in the same low range (e.g., Swanson, 2001). This puts a new wrinkle on the literature that has called for the elimination of "discrepancy" criteria in classifying students with RD by suggesting that discrepancies may be important in predicting treatment outcomes.

2. *Construct integrity.* Perhaps another step in better testing the importance of discrepancy-based criteria is to match classification measures to theoretical constructs. That is, a test of the construct validity of discrepancy groups stands a greater chance of being assessed if the constructs included in the classification of groups are firmly grounded in theory. Most critically, "there is little reason to believe, and certainly a lot of empirical support to disbelieve the contention, that some arbitrarily weighted function of two variables will properly define a construct" (see Cronbach & Furby, 1970, p. 79). Important criteria for establishing construct validity include the demonstration of convergent and discriminant validity of the measures. Although the majority of studies in this synthesis used the WAIS and standardized reading tests (WJ-reading cluster) to determine discrepancy criteria, this is not an argument for conceptual integrity. Neither a theoretical rationale nor empirical evidence is available to substantiate the claim that IQ tests (e.g., WAIS) capture the construct of "potential." Quite simply, it is not the case that individuals with comparable reading scores have the same potential. In addition, a difference between an intelligence score on the Wechsler test and a serious performance deficit on the Woodcock Johnson (or any other achievement test) in the area of reading, as reflected in the majority of studies in this synthesis, is not a valid test of a discrepancy model.

3. *Independence of measures.* Another step in testing the discrepancy notion is to compare the groups on process measures weakly related to the components of discrepancy scores. Discrepancy scores (or discrepancy-defined groups) are correlated with their component parts, and, therefore, the discrepancy measure will relate significantly to other variables that correlate with the component parts (Cronbach & Furby, 1970). Because discrepancy scores correlate with their component parts, there is a greater than chance tendency for them to be correlated with other variables associated with those component parts.

An example of the above rule is as follows: When (a) reading recognition is part of the discrepancy score, and when (b) low-reading-ability groups are comparable on reading recognition performance, then performance is comparable between discrepancy and nondiscrepancy groups on processes (e.g., phonological awareness) that relate to reading. Thus, the discrepancy group is little more than a surrogate of the poor-reading group. This problem (i.e., circularity in findings) has been recognized in the literature for some time (Cronbach & Gleser, 1953; Lord, 1956) and is reflected in the current synthesis (see table 3). In fact, it has been demonstrated that systematic relationships between component or correlate scores and difference scores exist even when the difference scores are generated randomly (Wall & Payne, 1973).

PRACTICAL APPLICATION

Taking the aforementioned findings together, what practical conclusions can be drawn to direct assessment practices of RD in adults? To answer this question, we must first state assumptions about RD. The case for RD in adults (in contrast to other reading problems) rests on three assumptions: (a) reading difficulties are *not* due to inadequate opportunity to learn, general intelligence, or to physical or emotional/behavior disorders, but to *basic* disorders in specific cognitive information processes; (b) these specific information-processing deficits are a reflection of neurological, constitutional, and/or biological factors (Grigorenko, 2001; Shaywitz et al., 2002); and (c) these specific information processing deficits underlie a limited aspect of academic behavior (i.e., reading) (Fletcher et al., 2003; Swanson, 1991). Thus, to assess RD at the behavioral level, systematic efforts are made to detect (a) normal psychometric intelligence, (b) below-normal achievement on standardized measures of reading (e.g., word recognition), (c) below-normal performance in specific cognitive

processes (e.g., phonological awareness, verbal memory), (d) that evidence-based instruction has been presented under optimal conditions but deficits in isolated cognitive processes remain, and (e) that cognitive processing deficits are not directly caused by environmental factors or contingencies (e.g., SES).

In essence, we would argue that the identification of adults with RD requires the documentation of normal verbal intelligence (i.e., individuals do not suffer from mental retardation), deficient reading performance that persists after evidence-based instruction has been systematically provided, average math scores, and deficit cognitive processes (phonological processing, naming speed, and verbal memory). What this synthesis has done in meeting the aforementioned assumptions is to provide a comprehensive model that establishes differences between adults with RD and those without RD. As shown in table 6, a valid assessment model includes measures of verbal IQ, reading comprehension, and word recognition, measures of process (e.g., naming speed, phonological, verbal memory), basic reading and language skills (e.g., word attack, vocabulary, spelling), and math. Our results also show that cutoff scores can be established on IQ measures (e.g., IQ scores > 100) to differentiate between poor readers. The higher-IQ RD group is more likely to suffer greater deficits in phonological processing and verbal memory relative to their average-reading peers than studies with RD samples that report IQ scores below 100. No doubt, information related to the long-term difficulties in reading experienced by adults with RD and their systematic exposure to evidence-based reading instruction would need to be provided by service providers who are collaborating in the assessment process.

Recommendations: Linking Assessment to Instruction

The current analysis found no studies that linked assessment procedures to instructional outcomes. Thus, although we have identified critical areas for the assessment of adults with RD from the general population, we can only provide indirect evidence to assist in the development of effective instructional practice. As indicated in Chapter 5 (also see Mellard & Scanlon, 2006), instructional research on adults with LD is meager, few studies to date would be considered experimental (four were identified in chapter 5), and none would meet the standards established by the What Works Clearing House (U.S. Department of Education, Institute of Education Science/National Center for Education Evaluation and Regional Assistance). For example, several studies include as assessment data only self-reports, and the outcomes of treatment are not based on randomized control conditions. Further, the research literature on accommodations (procedures that allow equal opportunity to demonstrate knowledge; see chapter 4) has been primarily limited to variations in testing (e.g., extended time). A meta-analysis by Gregg and Nelson (2008) indicates that although adults and adolescents with LD benefit from extended time on tests, they still lag significantly below their peers.

Because of the limited database linking assessment to instruction, we relied on a previous meta-analysis completed on intervention studies for students with learning disabilities from 1963 to 2000 (Swanson, 2000a; Swanson, Hoskyn, & Lee, 1999). This meta-analysis was funded by the U.S. Department of Education to synthesize all experimental intervention research conducted on students with LD over a 35-year period (see Swanson, Hoskyn, & Lee, 1999). Swanson and several colleagues (e.g., Swanson, 1999a, 2000b; Swanson & Deshler, 2003; Swanson

& Hoskyn, 1998; Swanson & Sachse-Lee, 2000) synthesized articles, technical reports, and doctoral dissertations that reported on group-design and single-design studies published between the years of 1963 to 2000. This comprehensive meta-analysis of the experimental intervention literature on LD has made specific instructional applications to adolescents with LD (e.g., Swanson, 2001; Swanson & Deshler, 2003; Swanson & Hoskyn, 2001), reading interventions (Swanson, 1999b), and IQ x reading x instruction interactions (Swanson, 1999a). Of 180 group design studies included in the synthesis, 70% focused on reading (Swanson & Hoskyn, 1998). Thus, we provide guidelines related to instruction based on a previous meta-analysis of effective reading instruction. These guidelines were based on a regression analysis that identified the instructional components of reading instruction that positively predicted the magnitude of effect sizes in reading outcomes (see Swanson, 1999b, 2000b, for review). Interventions were analyzed at three levels: general models of instruction, tactics used to convey information, and components that were most important to positively increasing the magnitude of instructional outcomes (effect size).

In terms of general models, their synthesis of methodologically sound studies (those studies with well-defined control groups and clearly identified samples) found that positive outcomes in remediation reading were directly related to a combination of direct and strategy instructional models. These models included a graduated sequence of steps with multiple opportunities for overlearning the content and skills, cumulative review routines, mass practice, and teaching of all component skills to a level that showed mastery. The interventions involved (a) teaching a few concepts and strategies in depth rather than superficially, (b) teaching students to monitor their performance, (c) teaching students when and where to use the strategy in order to enhance generalization, (d) teaching strategies as an integrated part of an existing curriculum, and (e) providing teaching that included a great deal of supervised student feedback and practice. In terms of tactics, Swanson (2000b) divided studies into eight models based on key instruction tactics: direct instruction (a focus on sequencing and segmentation of skills), explicit strategy training, monitoring (teaching students strategies), individualized and remedial tutoring, interactive small-group instruction, teacher-indirect instruction (teacher makes use of homework and peers' help for instruction), verbal questioning/attribution instruction (asking students key questions during the learning phase and whether they thought what they were learning would transfer), and technology (using computers to present concepts). The results indicated that explicit strategy instruction (explicit practice, elaboration, strategy cuing) and small group interactive settings best improved the magnitude of treatment outcomes. Explicit strategy instruction included two key components. One component included strategy cues. These studies included instructional components related to reminders to use strategies or multisteps, the teacher verbalizing steps or procedures to solve problems, and use of "think-aloud" models. The other component of strategy instruction was elaboration. These studies included instructional components related to providing additional information or explanations about concepts and/or providing redundant text or repetition within text.

The aforementioned meta-analyses also found that effective instructional models followed a *sequence of events*: State the learning objectives and orient the students to what they will be learning and what performance will be expected of them followed by these components:

1. Review the skills necessary to understand the concept.
2. Present the information, give examples, and demonstrate the concepts/materials.
3. Pose questions (probes) to students and assess their level of understanding and correct misconceptions.

4. Provide group instruction and independent practice. Give students an opportunity to demonstrate new skills and learn the new information on their own.
5. Assess performance and provide feedback. Review the independent work and give a quiz. Give feedback for correct answers and reteach skills if answers are incorrect.
6. Provide distributed practice and review.

The meta-analyses also found that some instructional components were far more important than others. For reading comprehension, those key instructional components that contributed in significantly improving the magnitude of outcomes were:

1. *Directed Response/Questioning.* Treatments related to dialectic or Socratic teaching, the teacher directing students to ask questions, the teacher and a student or students engaging in reciprocal dialogue.
2. *Control Difficulty or Processing Demands of Task*. Treatments that included short activities, level of difficulty controlled, teacher providing necessary assistance, teacher providing simplified demonstration, tasks sequenced from easy to difficult, and/or task analysis.
3. *Elaboration*. Treatments that included additional information or explanation provided about concepts, procedures or steps, and/or redundant text or repetition within text.
4. *Modeling by the Teacher of Steps*. Treatments that included modeling by the teacher in terms of demonstration of processes and/or steps the students are to follow to solve the problem.
5. *Small-Group Instruction*. Treatments that included descriptions about instruction in a small group, and/or verbal interaction occurring in a small group with students and/or teacher.
6. *Strategy Cues.* Treatments that included reminders to use strategies or multisteps, use of "think-aloud" models, and/or teacher presenting the benefits of strategy use or procedures.

In contrast, the important instructional components that increased the effect sizes for word recognition were:

1. *Sequencing.* Treatments included a focus on breaking down the task, fading of prompts or cues, sequencing short activities, and/or using step-by-step prompts.
2. *Segmentation*. Treatments included a focus on breaking down the targeted skill into smaller units, breaking into component parts, segmenting and/or synthesizing components parts.
3. *Advanced Organizers.* Treatments included a focus on directing students to look over material prior to instruction, directing students to focus on particular information, providing prior information about task, and/or the teacher stating objectives of instruction prior to commencing.

The importance of these findings is that only a few components from a broad array of activities were found to enhance treatment outcomes.

Two very important instructional components emerged in the analysis of treatments for students with reading disabilities. One component was explicit practice, which included activities related to distributed review and practice, repeated practice, sequenced reviews, daily feedback, and/or weekly reviews. The other component was advanced organizers, which included: (a) directing students to focus on specific material or information prior to instruction, (b) directing students about task concepts or events before beginning, and/or (c) the teacher stating objectives of the instruction.

This information, coupled with the findings in chapter 4, provide some direction in designing effective instruction for adults with RD.

SUMMARY

An analysis of effect sizes highlighted the primary areas to assess and diagnose in adults suspected of having RD. It is important to note, however, that in contrast to current alternative assessment procedures suggested for children, such as response to instruction, dynamic testing, and progress monitoring, we found no empirical studies comparing adults with RD with these alternative models. Thus, the literature reviewed included only studies that directly compared adults with RD and those without RD across a broad array of academic, cognitive, behavioral, vocational, and neuropsychological measures.

The results indicate that specific cognitive and language processes of adults with RD are distinguishable from those of adult skilled readers, adults with low IQ and reading scores, and adults with ADHD. The results support the notion that the primary processes that underlie RD in children are the same as those in adults. For example, the results show that phonological processing deficits are related to RD in adults. However, the deficits in processing in adults with RD are much broader than a phonological core. Although a large amount of literature on adults with RD has been directed toward word recognition processes, and rightly so, processes related to memory, vocabulary, and naming speed play just as important a role. For example, phonological processing was no more important than verbal intelligence and memory in moderating ES differences in our synthesis. What these findings seem to imply is that no one cognitive process clearly dominates the other in the assessment of adults with RD. Rather, it is the coordination of several processes that may provide the best account of adults with RD. We find that verbal intelligence plays a critical role in moderating the magnitude of cognitive and language measures across studies.

Taken together, our synthesis supports previous work showing that validity and reliability problems exist with discrepancy scores, but there have been few studies that have determined whether discrepancies in IQ and reading in high-risk samples accomplish something beyond classification criteria. One obvious test of the validity of discrepancy models is to test whether some adults defined by discrepancy scores are more likely to respond better to a treatment when compared to those poor-achieving adults without discrepancies. Responsiveness to instruction seems to be a missing test in all the studies reviewed comparing discrepancy and nondiscrepancy groups. To date, there are no systematic analyses supporting the notion that the discrepancy model is a useable construct when it comes to intervention and prognosis of intervention for adults with RD. The present synthesis has also confirmed what has been known about the limitations of discrepancy scores for some time (e.g., Cronbach & Furby, 1970). We suggest that the assessment of RD would be better served by using cutoff scores (i.e., verbal IQ > 100, math > 90, reading scores < 90) until the aforementioned assumptions for testing the validity of discrepancy scores as they relate to treatment outcomes occur.

Appendix A: Methods — Calculation of Effective Sizes, Statistical Analysis, and Interrater Agreement

CALCULATION OF EFFECT SIZES

For each measure, an ES was computed, Cohen's *d* (Cohen, 1988) and was then weighted by the reciprocal in the sampling variance (Hedges & Olkin, 1985). The dependent measure for the estimate of effect size (ES) was defined as est = $d/(1/v)$, where *d* (mean of RD - mean of comparison group/average of standard deviation for both groups), and v is the inverse of the sampling variance, $v = (N_{RD}+N_{nRD})/(N_{RD} \times N_{nRD}) + d^2/[2(N_{RD} + N_{nRD})]$ (Hedges & Olkin, 1985). Means and standard deviations were used in the computation of 98% of the ESs. In the remaining cases, F-ratios and t-ratios were converted to ESs. Thus, effect sizes were computed with each effect size weighted by the reciprocal of its variance, a procedure that gives more weight to effect sizes that are more reliably estimated. The overall results for RD when compared to non-RD adults are shown in table 2. As suggested by Hedges and Olkin (1985), outliers were removed from the analysis of main effects. Outliers were defined as ESs lying beyond the first gap of at least one standard deviation between adjacent ES values in a positive direction (Bollen, 1989). Ten ESs were removed from the analysis. Cohen's criterion was used for the interpretation of the magnitude of the ESs.

We also determined whether a set of *d*s shared a common effect size (i.e., was consistent across the studies) by category. The analysis of each category of measure reported separately is shown in table 2. For the category of each dependent measure, a homogeneity statistic Q was computed to determine whether separate ESs within each category shared a common ES (Hedges & Olkin, 1985). The statistic Q has a distribution similar to the distribution of Chi-square with *k*-1 degrees of freedom, where *k* is the number of ESs. A significant Chi-square indicated that the study features significantly moderated the magnitude of ESs. If the homogeneity was not achieved (which is usually the case), then the influence of outliers was assessed using a 95% confidence interval. Because we expected the absence of homogeneity, the subsequent analyses determined how the characteristics of the sample (e.g., IQ, reading) of the various studies contributed to the variability and the heterogeneity of effect sizes. To determine the relationship between sample characteristics and the magnitude of effect sizes, a conditional model was analyzed. Categorical models, analogous to an Analysis of Variance, showed whether the heterogeneity in effect sizes was isolated to a particular variable (e.g., severity of reading performance). The procedure for calculating categorical models provides a between-class effect. This procedure was considered helpful in determining if certain characteristics of the sample (e.g., age, high and low IQ) made a significant contribution to effect size.

STATISTICAL ANALYSIS

The data reflected effect sizes nested within domains (category of the dependent measure) nested within studies. Thus, a hierarchical linear model (HLM) (Bryk & Raudenbush, 1992; Singer, 2002) was developed that analyzed effect sizes nested between domains and studies. To examine effect sizes, we used a random effects model (Singer, 2002). The unconditional means model is expressed as:

$$y_{ij} = \beta_{o1} + U_{o1j} + U_{02j} + R_{ij}$$

where y_{ij} is the dependent variable (e.g., effect size), β_{o1} is the grand mean. U_{o1j} is the random intercept for study *j* in the sample representing variation between studies, and U_{02j} is the random intercept representing variation of effect sizes for domains nested within studies. The between-study variance components, $\tau^2_0 = \text{Var}(U_{0j})$ and $\tau^2_{01} = \text{Var}(U_{01j})$, reflected individual studies in effect sizes as a function of categories of the measures embedded within studies and effect size across studies. A simple conditional model can be expressed as:

$$y_{ij} = \beta_o + \beta_{o1}(\text{IQ level}) + \beta_{o2}(\text{reading level}) + \beta_{o3}(\text{domain}) + U_{oj} + U_{01j} + R_{ij}$$

where y_{ij} is the dependent variable (e.g., effect size), β_o is the grand mean, β_{o1} and β_{o2} are the classification measures, and β_{o3} is a binary variable related to domain comparison (e.g., effect size related to the domain of phonological processing). The domain variables were entered as binary variables (e.g., phonological processing +1, other domains 0). The same two random effects and the residual, as included in the unconditional model, were also included in the conditional model. The fixed- and random-effect parameter estimates were obtained using PROC MIXED in SAS 9.1 (SAS Institute, Inc., 2003). We tested the conditional models. The first conditional model tested whether the classification variables and the type of domains contributed significantly to the magnitude of effect size. The second conditional model (see formula above) tested whether a parsimonious model was a better fit for the effect sizes.

As shown at the bottom of table 6, we tested whether adding one or more predictors to the model reduced the magnitude of the various random components related to study effects. The random effects of the unconditional model represented the proportion of variance in the effects that were parameter specific rather than error variance. To evaluate the compatibility of the data with our conditional model, we tested the significance of the model change. This was done by using the differences between the deviance value (i.e., lack of correspondence between model and data) from the unconditional and conditional model as Chi-square values, and the number of parameters added for the conditional model as degrees of freedom. A significant Chi-square indicated that the conditional model showed a better fit to the data than the unconditional model. In general, models with lower deviance fit better than ones with higher deviance.

Snijders and Bosker (2003) argued that the power to detect significant parameters in multilevel research is frequently low because of reductions in parameter reliability. For this reason, we maintained all multiple comparisons at $p < .05$. We tested the models using both restricted maximum likelihood (REML) and maximum likelihood (ML) estimations to compute the parameters in the various models. However, because we compared variations in both the fixed effects and random effects, the results of the ML estimation were shown in tables 6–8. Prior to the analysis, we computed the intraclass correlation for effect sizes. The intraclass correlation exceeded .10, indicating that effect sizes within studies were more likely to have outcomes more similar to effect sizes within the various categories than to effect sizes in other studies (i.e., ESs were not independent of one another). Thus, it was necessary to portion the total outcome variance into between-study variance (random intercepts, τ^2), between-study variance within domains (e.g., phonological processes, rapid naming, memory), and within-classroom variance (residual error, σ^2).

To evaluate the compatibility of the data with our conditional model, we tested the significance of the model change. This was done by using the differences between the deviance value (i.e., lack of correspondence between model and data) from the unconditional and conditional models as Chi-square values, and the number of parameters that were added for the conditional model as degrees of freedom. A significant

chi square indicated that the conditional model showed a better fit to the data than the unconditional model. The models were compared utilizing several methods (i.e., deviance statistic, Akaike's Information Criterion [AIC], and Schwarz's Bayesian Information Criterion [BIC]). In all three methods, the smaller the value of the criterion relative to the other models, the better the fit of the model. Different models were compared by subtracting their deviance values. The degrees of freedom for the ΔX^2 equal the number of independent constraints imposed. Differences were then compared to critical values in an X^2 distribution. The AIC and BIC both attempt to find the model that can best explain the data with the minimum number of parameters. Both measures penalize for added parameters, while BIC also penalizes for sample size. When deviance goes down, indicating a better fit, both AIC and BIC also tend to go down. The BIC places a larger penalty on sample size and, therefore, leads to a preference of more parsimonious models (fewer parameters). When comparing variations in the fixed models, a maximum likelihood function should be used (Hox, 2002, p. 46).

INTERRATER AGREEMENT

One doctoral student coded all the studies. A second doctoral student provided interrater agreement for article inclusion and coding. The overall structure of the coding system yielded a reliable percentage of interrater agreement across all codes (> 95% agreement).

Appendix B: Results of the Meta-Analysis

STUDY CHARACTERISTICS

The current synthesis included 52 articles with 776 effect sizes comparing adults with RD and adults without RD. The mean ES for the 52 studies across all measures was .72 (SD = .54), which placed differences between adults with RD and without RD according to Cohen's (1988) criteria in the moderate to high range.

In terms of demographics in the samples, 74% of ESs came from the United States, 15% from the United Kingdom, 3% from Finland, 2% from France, 4% from Canada, and 2% from Australian samples. The total sample size across the 52 studies for adults with RD was 1,793 (M = 31.73, SD = 28.01), and the total sample size for adults without RD was 1,893 (M = 36.41, SD = 36.41). The age range for adults with RD varied from 18 to 42 years (M = 24.69, SD = 5.82), and adults without RD varied from 18 to 44 years (M = 23.93, SD = 5.95). Articles were published most frequently in the *Journal of Learning Disabilities, Annals of Dyslexia,* and *Learning Disability Quarterly.*

Thirty-nine studies provided data that allowed for calculation of the ratio of males to females in participant selection. The gender ratio (number of males/total sample) in which the number of males and females was reported was .55 (SD = .17) for adults with RD. Ethnic background was reported in eight studies. The ethnic ratio (number of whites-RD/total sample of RD) was .83 (SD = .27). No study separated reading performance as a function of gender, ethnicity, or SES. Therefore, performance between adults with RD and without RD as a function of gender, ethnicity, and/or SES could not be compared across the studies.

The most common assessment measures (norm-referenced or experimental) by category were as follows: reading comprehension (e.g., Nelson-Denny, Woodcock Johnson Psychoeducational Inventory, Woodcock Reading Mastery Test, Gray Oral

Reading Test), general intelligence (e.g., WAIS-full scale or performance scale, Raven Standard Progressive Matrices), verbal intelligence (e.g., WAIS-verbal scale), word recognition (e.g., WRAT, PIAT, WRMT), processing speed (e.g., tasks related to the rapid naming of objects, colors, numbers, and letters, WJIII-word fluency), phonological processing (e.g., experimental tasks related to phoneme deletion, nonword repetition, word comparisons), word attack (e.g., WRMT-word attack, WJPB-word attack, experimental tasks), arithmetic (e.g., WJPB-math, WRAT-arithmetic, PIAT-math), vocabulary (e.g., PPVT, WAIS-vocabulary, TOAL), spelling (e.g., WRAT-spelling, PIAT-spelling), writing (e.g., TOAL, WJPB-written language), social skills (e.g., Harter tasks related to perceived support, self-perception profile, help seeking,), problem solving (e.g., WAIS tasks related to block design comprehension, object assembly, WJPB-cognitive and reasoning ability), verbal memory (e.g., digit span, working memory task), visual-spatial memory (e.g., Corsi block span, Visual Motor Survey-visual index, spatial working memory), cognitive monitoring (e.g., trail making, token test, behavioral measure of attention), perceptual motor (e.g., balance measures, Luria-Nebraska Neuropsychological Battery [LNNB]-tactile), auditory-perceptual (e.g., auditory-only token test, rhyming task), visual-perceptual (e.g., visual search, design recognition, perceptual (e.g., LNN subtests, WAIS-visual matching), general information (e.g., WAIS-information, WJPB-knowledge aptitude), social expectations (e.g., grade point average, organization, manage time), personality (e.g., MMPI), and neurological (e.g., EEG, activation in temporal cerebellum).

Three of the 52 studies had sample comparisons that included adults with ADHD. The mean sample size (ADHD) for those studies was 39.67 (SD=15.57), the mean age was 26.17 (SD=6.09), the mean gender ratio was .51(SD=.11), and average ES across all measures when compared to adults with RD was -.09 (SD=.32). No information was provided to calculate ethnic ratio. Although overall ESs were low, as shown in table 2, medium to large ESs emerged between the adults with RD and adults with ADHD in favor of the ADHD group on measures of reading comprehension, word attack, and verbal memory.

CHARACTERISTICS OF SAMPLES ON READING, INTELLIGENCE MEASURES

Table 1 provides an overview of the reported norm-referenced psychometric information (e.g., IQ, reading) for adult participants with and without RD. Also included were norm-referenced scores on the ADHD samples in the three studies. Effect sizes were computed on the norm-referenced measures and are shown on the right side of table 1. Positive ESs favored adults without RD. As shown in table 1, mean standard scores for measures of word recognition, speed, phonological processing, word attack, and spelling were below the 25th percentile (< 90 standard score). For measures that included scale scores, verbal memory hovered around the 25th percentile (scale score of 8). Effect sizes comparing adults with and without RD were greater than a standard deviation on measures of reading (i.e., comprehension and word recognition), naming speed, basic reading skills (e.g., phonological processing, word attack), and spelling. Thus, the profiles for adults with RD were comparable to some of the reported profiles of children with dyslexia (see Shankweiler et al., 1995).

The ADHD group, when compared with adults with RD, had clear advantages in reading comprehension and verbal memory. An advantage emerged for adults with RD when compared to the ADHD group on measures of problem solving.

DOMAIN CATEGORIES

Table 2 provides the weighted mean ES (weighted by the reciprocal in the sampling variance) and standard errors, 95% confidence interval range, and chi

square for within-category homogeneity for each category. Prior to the analysis, scores related to error and naming speed measures were corrected (absolute values were calculated) for the direction of ES so they could be combined with measures of accuracy. Using Cohen's criterion, high ESs (> .80) occurred across all areas of reading and reading skills (i.e., reading comprehension, word recognition, speed of processing, phonological processing, word attack, and spelling). Moderate ESs (.50 to .80) emerged across several categories, such as verbal IQ, math, vocabulary, writing, and verbal memory. Low ESs occurred for measures of personality, external criterion measures, visual and auditory perception, and problem solving/reasoning. When comparing the weighted ESs, a significant effect was found for domain category, χ^2 (23, N=718) = 3288.11, $p < .0001$. A Scheffé test indicated that ESs were significantly higher (positive) for categories of reading comprehension, real-word identification, naming speed , phonological processing, word attack, and spelling when compared to the other domains. However, these overall results should be interpreted with caution because of the infrequent number of ESs.

CORRELATIONS

The ESs for the categories of dependent measures were correlated with the classification measures (IQ and reading). Table 3 shows the correlation between the ESs of adults with RD and average achievers as a function of the domain categories. To compute these correlations, ESs were aggregated (averaged) within the studies. Some categories had fewer than five studies and therefore were not reported. Because of the low power (N = 52 studies) in determining significance of the correlation, we relied on interpreting the magnitude of the correlation within the framework of Cohen's *d* (r=.10 equals a Cohen's *d* of .20, r=.30 equals a Cohen's *d* of .50, r=.50 equals a Cohen's *d* of .80). As shown in table 3, the sample age and gender ratio for adults with RD were not significantly related to any of classification measures of intelligence and reading. For measures of IQ, the ES for general IQ (full-scale scores, nonverbal IQ) was correlated with the category of problem solving. When correlated with verbal IQ, high correlations emerged for word attack, math, and problem solving. For measures of reading comprehension, high correlations emerged for phonological processing, vocabulary, writing, and verbal memory. For measures of word recognition, high correlations emerged for spelling, and moderate correlation emerged with measures of word attack and vocabulary.

Overall, the results suggest that ESs for the classification variables were correlated with ESs on a number of achievement, language, and cognitive measures. Thus, it was important to control for the intercorrelation among the measures in subsequent analyses.

MULTILEVEL MIXED MODELING

This next analysis sought to identify those processes most important in predicting ESs for differences between adults with and without RD. That is, given the large number of categories represented, it is important to identify those variables that significantly moderate differences between adults with and without RD independent of the influence of other variables. To address this concern we considered various HLM models.

We first calculated an unconditional model and then two conditional models (the latter being those that attempt to identify variables that significantly moderate ESs) using the SAS PROC MIXED program (SAS Institute, Inc., 2003). The unconditional model can be viewed as a one-way random-effects analysis of variance [ANOVA] model. This model has one fixed effect, intercept, and three variance components. The variance components for the random effects represented the variation (a) between the studies, (b) between studies with the type of category

nested within studies, and (c) within the studies' error. Random effects can be viewed as the variance of the true ESs in a population of studies from which the synthesized studies constituted a random sample.

The first conditional model tested whether the dependent variable (ES difference between RD and average achievers) was moderated by specific classification variables (IQ, reading) and demographic variables (age and gender), domain categorical variables, and random error. For the categorical variables, we determined if specific domains (e.g., phonological processing) moderated overall performance. As noted in table 2, some categorical domains yielded low or marginal ESs. To simplify the analysis, these categories were not entered into the HLM analysis. The categories entered into the mixed regression analysis are shown in table 6. In the present analysis, the measures of domain category (e.g., verbal IQ) were coded as dummy variables (e.g., 1 = verbal IQ, 0 = all other categories). These dichotomous variables (present as 1 vs. absent as 0) reflected a point biserial correlation with the overall ESs. That is, the category of the dependent variables represented the presence of the measures (coded as 1) when compared to all other measures (coded as 0). Age was a continuous variable reflecting the mean age of the sample. All predictor variables were grand mean centered to facilitate the interpretation of the intercept (ES). The dependent measure was the overall ES weighted for sample size.

In summary, we studied whether ESs between adults with and without RD varied across age, IQ, reading level, and the category of the dependent measure. This was done to determine those variables that moderated RD differences after classification variables (e.g., reading) were entered into the analysis. The goal of this analysis was to (a) determine those variables that best predict ESs when all other variables are entered simultaneously into the analysis, and (b) to identify those variables that reduce random effects related to differences between studies.

As shown in table 4, the unconditional model yielded parameter estimates for the fixed effects (the intercept) for the average ES in the sample of studies. For an unconditional model, there was only one fixed effect that provided an estimate. The estimated average ES across studies was .90 (SE=.06). Also shown in table 4, the random effects for intercepts (between study variance) and the residual (within studies) were significantly different from 0. These estimates indicated that substantial variation (according to the size of the estimate of the residual) existed between and within the studies. For the unconditional model, we computed an intraclass correlation by taking the ratio of the variance component between studies (.07 + .57 = .64) to the sum of the variance between and within ESs (.64 + .30 = .94). The intraclass correlation tells us the total proportion of variance across each individual study. The intraclass correlation was .68 (.64/.94). Thus, 68% of the variance in ESs between adults with and without RD was at the between-study level.

The unconditional model provided a baseline to compare our first conditional model that included main effects for age, variables used in the classification of RD (e.g., IQ, reading), and the comparison categories (e.g., phonological process, naming speed). The important question to be addressed was whether any of the classification, demographic, and/or domain categorical variables moderated ESs. Also of interest was whether the conditional model provided a good fit to the data, and whether the conditional model reduced the variance between studies as well as identified variables that significantly predict ESs. Table 5 shows a conditional model that entered the effects for age, gender ratio, classification variables (e.g., reading comprehension, general IQ, verbal IQ reading recognition), and the comparison categories (e.g., phonological processing, rapid naming). The estimates for each variable shown in table 5 have been partialed for the influence of all other variables.

The results in table 5 yielded two important findings. First, the conditional model substantially reduced the significant variance "between" studies. When comparing table 4 and table 5, the variance component representing the difference between the studies in the conditional model was compared to the unconditional model. The conditional model accounted for 84% of the explainable variance relative to *between*-study effects relative to the unconditional model (.64 - .10/.64 = .84). However, the within-study effects showed an increase in the conditional model (.35) when compared to the unconditional model (.30). This finding suggests that further modeling was necessary.

Second, a number of cognitive measures were significantly related to the overall ESs, even when the classification measures were entered into the analysis. The results showed that overall ESs between adults with RD and adults without RD were significantly moderated by unique variance in measures of verbal IQ, achievement (i.e., reading, math, vocabulary, and writing), phonological processing, naming speed, and verbal memory. In contrast, age, gender ratio, and the categories of problem solving and general information were not significant moderators of overall ESs. The Bonferroni correction for the inflation of alpha was .003 (.05/16), which suggested that the significant parameter estimate for the writing category may be related to chance.

An interpretation of the parameter estimates in table 5 follows. The intercept estimates the average study mean weighted ES (.65) when all the remaining predictors are at 0. Because the predictor variables (e.g., comprehension) were centered as the grand mean of 0, this tells us about the relationship between the overall ES (.65) and the categorical variable (i.e., reading comprehension). For example, the reading comprehension estimate was 1.34. Studies that differed by 1 point in comprehension—in this case, the dummy variable was positive, or +1—differed by 1.34 points in the overall ES. Because the estimate for reading comprehension was significant, there is a strong relationship between the reporting of performance for category of reading comprehension and overall ES.

To evaluate the compatibility of the data with the conditional model, we tested the significance of the model change. This was done by using the differences between the deviance values (i.e., lack of correspondence between model and data) from the unconditional and conditional growth model as Chi-square values, and the number of parameters that were added for the conditional model as degrees of freedom. A significant chi square would indicate that the conditional model shows a better fit to the data than the unconditional model. As can be calculated from the deviance values in table 4 (1696.5) and table 5 (1094.6), the difference score was significant, ΔX^2 (16) = 601.9, $p < .05$, suggesting that the conditional model was an excellent fit. Both the AIC and BIC estimates were lower than the unconditional model, suggesting an excellent fit to the data.

We next determined if a reduced model (or one that was more parsimonious) provided a good fit to the data. There is practicality in testing this model because not all measures can be administered in diagnosing RD in adults. As shown in table 6, the reduced model entered only those variables significant (in this case, $p < .003$) in the full model. As shown in table 6, all the moderator variables were significant. A likelihood ratio test (deviance test) was again computed that compared the unconditional model with the reduced model. The unconditional model (1696.5) and the reduced model (1536.8) were significantly different, ΔX^2 (10) =159.70, $p < .001$, suggesting the reduced model shown in table 6 was an excellent fit to the data. Both the AIC and BIC estimates were also lower than the unconditional model, thus confirming a good fit to the data.

The important finding from this analysis was that key independent variables (i.e., those that can be used to assess adults with RD) were identified that were

significantly related to overall performance differences between adults with RD and adults without RD. Significant moderators of differences between adults with RD and those without RD were measures of verbal IQ, reading comprehension, word recognition, measures of process (i.e., naming speed, phonological, verbal memory), basic reading and language skills (e.g., word attack, vocabulary, spelling), and variations in math.

TESTING THE VALIDITY OF THE DISCREPANCY MODEL

We next explored whether ESs across studies varied as a function of IQ and reading level. It is important to note that studies were selected for the synthesis that included samples with at least one reported standardized intelligence measure in the normal range. However, reading scores varied from below normal (< 85 standard score) to normal. For the present analysis, we aggregated all standardized IQ (general and verbal) and reading (word recognition and reading comprehension) measures within studies. (Note: The unique contribution of general vs. verbal IQ, and word recognition vs. reading comprehension, was addressed in the previous mixed-regression analysis.) The studies were divided into two reading groups: severe RD (i.e., studies reporting mean standardized reading scores for the RD sample at or below 89) and moderate RD (i.e., studies reporting standardized reading scores > 89). These studies were further subdivided into those yielding aggregate IQ scores at or above a mean IQ score (average of full and verbal) of 100 and those below a mean of 100. These studies were compared on the nonclassification measures. Because studies varied in the number of categories of dependent measures tested, those categories of dependent measures found significant in the previous analysis were aggregated (averaged) into those that focused on cognitive processing (e.g., rapid naming, phonological processing, verbal memory) and those that focused on language/reading skills (e.g., vocabulary, pseudoword reading, spelling). Thus, one aggregated ES represented cognitive processing or language/reading skills for each study.

Table 7 shows the unconditional means (Model 1) for all studies that reported ESs related to cognitive and language processing. Presented are the random portions (random effects) and overall mean ESs (fixed effects) for cognitive processing and language. For cognitive measures, the estimated variance (random effects) between studies (intercept) was .17. Also shown in table 7 is the residual (.33) that reflected the within-study variability. Shown in table 7 are the fixed effects. For cognitive measures, the fixed effect for the intercept indicated that the average ES comparing adults with RD and adults without RD across studies was 1.27. For language measures, the estimated variance (random effects) of study deviations from the overall variance around the intercept was .06, and the residual was .31. The fixed effect for the intercept indicated that the average ES across studies comparing adults with RD and adults without RD on language measures was 1.49.

The conditional model is shown at the bottom of table 7. We entered the dichotomous variables of intelligence (high vs. low IQ) and reading (severe vs. moderate), discrepancy variable (the interaction of intelligence x reading), ESs for IQ and reading, and the interaction of the ESs. When compared to the unconditional means model for the cognitive measures, the conditional model accounted for approximately 88% of the explainable variance [(.17 - .02)/.17] between studies on cognitive performance and 100% of the within-study variance. Likewise, the conditional model for the language measures accounted for approximately 93% of the explainable variance [(.06 - .004)/.30] between studies and approximately 81% [(.31 - .06/.31] of the explainable variance within studies. In general, entry of the IQ and reading variables effectively eliminated the majority of variance that existed between studies. Both the AIC and BIC estimates

are lower than the unconditional model, confirming a good fit to the data.

There were two important findings for the conditional models for both cognitive and language. First, cutoff scores related to overall intelligence were important in moderating ESs. Significant effects emerged between studies for the intelligence factor (high vs. low intelligence) but not for cutoff scores related to reading. The least square means of each cognitive and language measure are shown in table 8. The results show that the ES differences were substantially larger for adults with RD (i.e., the differences between RD and non-RD adults was greater) who have high intelligence scores than studies that reported participants with lower intelligence scores. Thus, the differences between adults with RD were greater for those with higher IQ than for those with lower IQs, a finding similar to Hoskyn & Swanson, 2000. The effect sizes were larger for studies with high-IQ participants on both cognitive (mean ES=1.22, SE=.16 vs. mean ES=.75, SE=.12) and language (mean ES=1.76, SE=.13 vs. mean ES=1.39, SE=.11) measures. Second, no significant interactions related to discrepancies (i.e., variations in level of IQ and reading) emerged in the analyses. This finding will be placed into perspective when discussed under the implications in the discussion section.

Profile of high- and low-IQ studies. Because studies that reported higher IQ scores yielded significantly larger ES scores (relative to average readers) than studies that reported lower IQ scores, a profile to understand these differences was necessary. A profile of the scores as a function of studies that report high and relatively low IQs is shown in table 9. As shown, the mean reading scores (i.e., word recognition and comprehension) were in the same range for studies with high IQ as those with relatively low IQs.

A further analysis was done comparing the relative differences in ESs across measures that were *not* used as part of the classification measures. As shown in table 9 on the right side, the mean ES for the studies with low IQs was subtracted from studies with higher IQs. The positive *difference* scores in table 9 indicated that studies with higher IQs showed greater differences (between adults with RD and without RD) than studies with low IQs. Because of the large range in the frequency of ES scores, for categories with 10 or more studies, we calculated ESs. Large positive ESs for phonological processing and memory indicated that the studies with higher IQ had greater differences with average achievers when compared to studies with RD samples that reported lower intelligence scores. Moderate ESs occurred for measures of spelling (M = .46) and word attack (M = .43). In contrast, ESs were greater on measures of problem solving for studies with lower IQs than higher IQ studies. (This latter finding makes sense because problem-solving measures overlap with measures of intelligence.) Moderate ESs emerged in favor of low-IQ studies (i.e., differences were greater between adults with and without RD) on measures of math (M = .43). The analyses showed that adults with RD who have IQ scores > 100 (based on cutoff scores used in the previous analyses) are more likely to suffer greater deficits in phonological processing and verbal memory relative to their average reading peers than studies with IQ scores below 100.

The reported standard scores across the various domains are shown in table 10. As shown in table 10, the most distinctive feature for studies with relatively high IQ scores was that they yielded substantially higher standardized math scores relative to studies that reported lower IQ scores. The high-IQ studies also yielded lower verbal memory scores relatively to studies that reported lower IQ scores.

A major limitation of our comparison is that we included studies that reported reading scores above the 25th percentile. The majority of syntheses that test the validity of the discrepancy models include only severely poor readers. Although we found IQ level was a significant factor for both severe and moderately poor readers (i.e., no interaction emerged),

these effects may not occur for studies that only include severely poor readers (in this case, composite reading scores below a standard score of 90, or the 25th percentile). A chi square weighted for sample variance (Hedges & Olkin, 1985) was computed on the aggregated ESs for these studies. A significant effect emerged for IQ level, $\chi 2$ (1, N = 16) = 8.22, $p < .001$, for the cognitive processing measures. Studies with relatively lower IQs (N = 10) yielded lower ESs (mean = .64, SE = .12) between adults with RD and without RD (the differences between adults with RD and adults without RD were greater) than studies with higher IQs (N = 6, mean = 1.07, SE = .20) on measures of cognitive processing. A significant effect emerged for IQ level also for language measures, $\chi 2$ (1, N = 16) = 7.31, $p < .001$. Studies with relatively lower IQs (N = 12) yielded lower ESs on language measures (mean = 1.25, SE = 16) between adults with RD and without RD (the differences between adults with RD and adults without RD were greater) than studies with higher IQs (N = 5, mean = 1.71, SE = .32).

Profile of studies reporting and not reporting math scores. To complete our analysis, we determined if the reporting of math scores was critical in defining adults with RD relative to reading and intelligence measures. The two outcome measures (cognitive processing and language processing) are shown in table 11. For comparison purposes, a contrast variable was created for those studies with no reported math scores (scored as 0), studies that reported ESs below 1.0 (coded as +1), and studies that reported ESs greater than 1.0 (coded as -1). As shown in table 11, along with IQ, the contrast variable for math was significantly related to cognitive processing. The positive parameter estimate indicated that studies that reported small differences in math performance between adults with and without RD yielded larger effect sizes in cognitive differences. However, the contrast variable did not significantly moderate language processing. Overall, inclusion of math scores was a significant moderator of ES. The results also suggest that the direction of the parameter estimate indicated that low ESs in math were significantly related to increased differences in ESs for cognitive and language processing performance.

Notes

[1]It is important to note that moderator and mediator variables are not mutually exclusive. Moderator variables specify the specific condition (high vs. low phonological skills, high vs. low verbal IQ) under which the relationship between an independent variable (RD vs. non-RD) and dependent variable (phonological processing) takes on a different direction or strength (Baron & Kenny, 1986). In contrast, mediators specify the mechanism by which the independent variable influences the dependent variable. The two processes may combine so that the moderator variable may be mediated by another variable (e.g., variations in phonological training).

[2]At the onset of selecting studies for this synthesis, adults (18 years and older) with RD were broadly defined in our search as those individuals with average intelligence who exhibit poor reading skills. We used a cutoff score for IQ of 80. Although several measures of IQ may be reported within a study, at least one norm-referenced measure needed to be at or above a standard score of 80 (scale score of 7). This cutoff score has been used in previous meta-analyses (Hoskyn & Swanson, 2000; Stuebing et al., 2002) and is considered the upper threshold for individuals with mild retardation. We used standardized reading scores below the 25th percentile as those adults with severe RD and those at or

above the 25th percentile as those with moderate disabilities. The 25th percentile is a common cut-off score in the literature on subtyping RD from other academic difficulties (Fletcher et al., 1992). As can be determined from appendix A, some studies included adults with RD who had some reading scores in the normal range. These studies were left in the analysis from comparison purposes. Thus, no restrictions were placed on studies in terms of the degree of discrepancy between IQ and reading. The large variations in IQ and reading across studies allowed for comparisons on measures as a function of high and low IQ and high and low reading scores.

[3] An important extension of the multilevel regression model for meta-analysis is to allow for more than two levels (see Hox, 2002, p. 152, for review). That is, there are several outcome measures for each study. The typical approach for analysis is to combine effect sizes into a single outcome per study or to carry out a separate analysis for each different outcome. However, multivariate modeling allows for an analysis of all the different outcomes and provides an estimate for missing data for studies that do not provide data for all available outcome measures. Maximum likelihood (ML) procedures were used to determine parameter estimates because the ML estimation procedure has several advantages over other missing-data techniques (Peugh & Enders, 2004).

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Table 1

Psychological and Achievement Profiles on Standardized Norm-Referenced Measures for Adult Participants With and Without Reading Disabilities

	Chronologically Age Matched (N = 1,162)			Reading Disabled (N = 1,719)		Effect Size	
	K	M	SD	M	SD	M	SD
Norm-Referenced							
Reading Comprehension	33	109.87	11.29	93.05	12.29	1.25	.73
Other[a]	1	98.60				.62	
General Intelligence	46	110.55	6.89	104.64	11.62	.26	.67
Other	5	101.54	5.01			.04	.75
Verbal Intelligence	19	110.60	9.00	101.36	12.63	.69	.61
Other	2	102.00	2.12			.38	.71
Word Recognition	30	107.19	8.24	88.65	10.16	1.64	.79
Other	2	102.20	2.12			.38	.71
Fluency/Rapid Naming	15	105.93	6.36	88.72	16.40	1.01	.6
Phonological Processing	8	105.48	24.03	76.26	16.96	1.60	.68
Word Attack	21	105.82	8.23	87.17	11.88	1.68	.72
Math	14	106.23	8.71	93.64	10.31	.88	.82
Vocabulary	17	104.89	7.39	92.30	11.28	.88	.649
Spelling	20	107.89	7.02	87.62	9.88	1.77	.66
Writing	8	101.94	7.95	88.15	11.07	.81	1.10
Problem Solving/ Reasoning	29	11.94	1.88	11.32	1.70	.04	.30
Other	3	8.90	.17			-.84	.28
Memory-Verbal	21	9.99	3.38	8.13	2.21	.81	.80
Other	2	12.90	.42			.66	.05

Note. Chronological age reflects months. Positive effect size is in favor of the contrast group and negative effect size is in favor of RD group.

[a] "Other" refers to a chronologically age-matched ADHD group in study (not part of the average achievers).

K= Number of effect sizes.

[b]Reported as a scale score (M = 10, SD = 3).

Table 2

Weighted Effect Sizes, Standard Error, Confidence Intervals, and Homogeneity of Categories for Comparisons Between Adults With and Without RD (Corrected for Outliers)

Comparison	K	Effect Size	Standard Error	Lower	Upper	Homogeneity Q
Total Across Categories						
RD/NRD	776	.54	.01	.52	.56	7356.44***
RD/Other	35	.10	.04	.01	.18	279.72***
1. Reading Comprehension						
RD/NRD	53	1.20	.04	1.12	1.28	293.04***
RD/Other	1	.62				
2. General Intelligence						
RD/NRD	48	.20	.03	.13	.28	250.16****
RD/Other	5	.09	.11	-.12	.32	35.24***
2.1 Verbal Intelligence						
RD/NRD	20	.63	.05	.50	.74	94.19***
RD/Other	2	.41	.17	.06	.75	8.14*
3. Reading Recognition						
RD/NRD	43	1.37	.04	1.28	1.44	210.67***
RD/Other	1	1.40				
4. Speed of Processing (e.g., letter naming, etc.)						
RD/NRD	56	.96	.03	.88	1.04	184.19***
RD/Other	6	-.82	.09	-1.02	-.63	1.89
5. Phonological Processing						
RD/NRD	42	.87	.05	.77	.98	199.08***
6. Word Attack						
RD/NRD	55	1.33	.03	1.25	1.41	284.18***
RD/Other	2	.53	.18	.17	.89	19.29***
7. Math						
RD/NRD	32	.75	.03	.68	.83	189.19***
8. Vocabulary						
RD/NRD	29	.71	.04	.62	.80	163.52***
9. Spelling						
RD/NRD	33	1.57	.05	1.47	1.67	258.25***
10. Writing						
RD/NRD	11	.72	.07	.58	.86	162.18***

Comparison	K	Effect Size	Standard Error	Lower	Upper	Homogeneity Q
11. Social and Personal Skills						
RD/NRD	34	.10	.03	.02	.17	121.29***
12. Problem Solving and Reasoning						
RD/NRD	38	.11	.04	.03	.20	151.36***
RD/Other	3	-.83	.15	-1.14	-.53	2.15
13. Verbal Memory						
RD/NRD	44	.62	.04	.53	.71	282.3***
RD/Other	3	.44	.14	.16	.72	4.17
13.1 Visual-Spatial Memory						
RD/NRD	6	-.39	.12	-.63	-.14	10.76
13.2 Cognitive Monitoring						
RD/NRD	19	.27	.06	.15	.39	94.31**
RD/Other	8	.37	.08	.20	.54	13.78*
14. Perceptual Motor Skills						
RD/NRD	66	-.13	.03	-.19	-.07	564.52***
14.1 Auditory-Perceptual						
RD/NRD	27	-.18	.06	-.31	-.06	108.35***
RD/Other	1	.97				
14.2 Visual-Perceptual						
RD/NRD	14	.13	.11	-.09	.35	3.96
15. General Information-Long term memory (LTM)						
RD/NRD	9	.47	.08	.31	64	73.60***
16. External Criterion						
RD/NRD	11	-.23	.05	-.33	-.12	165.84***
17. Personality						
RD/NRD	16	.28	.04	.19	.37	188.97***
18. Brain and Neuropsychological Areas (e.g., EEG)						
RD/NRD	57	-.02	.05	-.12	.07	178.08***

Note: NRD = nonreading-disabled average achiever; RD = reading disabled; "Other" = ADHD group; K = number of measures; "Lower" and "Upper" = 95% level of confidence range. ° Positive effect sizes favor NRD and negative effect sizes favor RD group.
*$p < .05$
**$p < .01$
***$p < .001$

Table 3

Correlations of Age, Gender Ratio, and Categorical Variables With Total Effect Size (RD/NRD) Across Domains, Effect Size for IQ, Reading, and Math (Aggregated by Study)

	ES – General IQ	ES – Verbal IQ	ES – Reading Comprehension	ES – Word Recognition
Age	-.31	-.27	-.18	.10
Gender Ratio	.10	.44	.11	.04
Speed	-.04	.08	.45	.22
Phonological Processing	-.36		-.85**	-.21
Word Attack	.30	.77	-.07	.48*
Math	.35	.71	-.01	.09
Vocabulary	.47		.54*	.48
Spelling	-.28	.09	-.26	.78**
Writing	-		.98*	-
Problem Solving	.95*	.61	.14	.08
Memory-Verbal	-.37	.31	.67*	-.03
Perceptual-Visual	.28		-	.33

Categories such as social skills, personality, and visual-spatial memory were not calculated because the number of studies was at or below five. Correlations of aggregated effect sizes from six or more studies were computed.
r=.10 equivalent to Cohen's *d*=.20, r=.30 equivalent to Cohen's *d*=.50, r=.50 equivalent to Cohen's *d*=.80.
Note: - = Insufficient number of studies (N < 5) to compute correlation.
* $p < .05$
** $p < .01$
*** $p < .001$

Table 4

HLM Regression Predicting Effect Sizes Comparing Adults With Reading Disabilities and Without Reading Disabilities

Unconditional Model

Fixed Effect				
	Estimate	SE	t-ratio	*p* value
Intercept	.90***	.06	14.20	<.001
Random Effect (covariance parameter estimates)				
	Estimate	SE	Z	*p* value
Study[a]	.07*	.03	1.76	.04
Domain[a]	.57***	.06	8.56	< .0001
Residual[b]	.30***	.05	18.21	< .0001
DEVIANCE	1696.5			
AIC	1704.1			
BIC	1712.5			

[a]Intercept variance between studies.
[b]Variance within studies.
* p < .05,
*** p < .001

Table 5

Conditional Model Predicting Effect Sizes for All Measures Comparing Adults With RD and Without RD

Fixed Effect				
	Estimate	SE	t-ratio	*p* value
Intercept	.65***	.08	7.53	< .0001
Age RD	-.01	.01	-1.04	.30
Gender Ratio	-.20	.37	-.55	.58
Classification Variables				
General Intelligence	.23	.15	1.67	.09
Verbal IQ	.73***	.19	3.69	.0003
Reading Comprehension	1.34***	.15	8.62	.0001
Word Recognition	1.52***	.15	9.54	.0001
Comparison Measures				
Naming Speed	1.09***	.15	7.09	.0001
Phonological Processing	.97***	.15	6.15	.0001
Word Attack	1.56***	.14	10.77	.0001
Math	.78***	.16	4.91	.0001
Vocabulary	.84***	.17	4.87	.0001
Spelling	1.83***	.16	11.09	.0001
Writing	.72	.23	3.03	.002
Problem Solving	.16	.14	1.16	.24
Memory-Verbal	.69***	.13	5.02	.0001
General Information	-.10	.27	-.39	.69
Random Effect (covariance parameter estimates)				
	Estimate	SE	Z	*p* value
Study[a]	.10**	.04	2.42	.007
Domain[a]	.01**	.005	2.68	.003
Residual[b]	.35***	.02	15.48	.0001
DEVIANCE	1094.6			
AIC	1134.6			
BIC	1168.9			

Note: ES = Effect size between RD and average achievers.
*$p < .05$
**$p < .01$
***$p < .001$

Table 6

Conditional Model Predicting Effect Sizes for All Measures Comparing Reading-Disabled and Average Achievers

Fixed Effect				
	Estimate	SE	t-ratio	*p* value
Intercept	.76***	.06	12.08	< .0001
Age RD	-			
Gender Ratio	-			
Classification Variables				
General Intelligence	-			
Verbal IQ	.53**	.15	3.44	.0003
Reading Comprehension	1.14***	.11	9.98	.0001
Word Recognition	1.50***	.11	12.77	.0001
Comparison Measures				
Naming Speed	.98***	.11	8.77	.0001
Phonological Processing	.93***	.12	7.39	.0001
Word Attack	1.48***	.10	13.78	.0001
Math	.62***	.14	4.40	.0001
Vocabulary	.65***	.14	4.60	.0001
Spelling	1.80***	.12	13.93	.0001
Writing	-			
Problem Solving	-			
Memory-Verbal	.56***	.11	4.83	.0001
General Information	-			

Random Effect (covariance parameter estimates)				
	Estimate	SE	Z	*p* value
Study[a]	.09	.03	2.62	.004
Domain[a]	.001	.0004	2.87	.002
Residual[b]	.40	.02	17.48	.0001
DEVIANCE	1536.8			
AIC	1564.8			
BIC	1592.3			

Note: ES = Effect size between RD and average achievers.
**$p < .01$
***$p < .001$

Table 7

Comparison of All Studies That Reported Effect Sizes for Cognitive and Language Processing Separated by Variations in Intelligence and Reading

Unconditional Model

	Cognitive Processing		Language Processing	
Random Effects	Variance	SE	Variance	SE
Between Study-Intercept	.17	.12	.06	.08
Residual	.34	0	.31	0
Deviance	74.1		64.8	
AIC	80.1		70.8	
BIC	85.9		76.6	
Fixed Effects	Estimate		Estimate	
Intercept	1.27**	.12	1.49**	.10

Conditional Model

Random effects	Variance	SE	Variance	SE
Between Study-Intercept	.02	.05	.004	.02
Residual	0		.06	0
Deviance	21.0		3.1	
AIC	39.0		21.1	
BIC	50.3		32.5	
Fixed Effects	Estimate		Estimate	
Intercept	1.02**	.12	1.61***	.07
Explanatory Variables				
High vs. Low Intelligence	.29*	.13	.24**	.09
Severe vs. Moderate Reading	.10	.11	-.06	.07
Discrepancy-Intelligence x Reading	.05	.11	.05	.07
ES Intelligence	.26	.33	.28	.19
ES Reading	.08	.25	.59	.15
ES Intelligence x Reading	.24	.55	-.27	.31

* $p < .05$
** $p < .01$
*** $p < .001$

Table 8

Mean Effect Size as Function of Severity of Reading Disability and Intelligence Scores

1. Cognitive Processing (aggregate of naming speed, phonological processing, verbal memory)

	Severe RD		Moderate RD	
	M	SE	M	SE
High IQ	1.14	.24	1.45	.24
Low IQ	.66	.21	.76	.27

N=31 studies.

2. Language (vocabulary, nonword reading, spelling)

	Severe RD		Moderate RD	
	M	SE	M	SE
High IQ	1.77	.23	1.74	.10
Low IQ	1.39	.11	1.15	.16

N=32 studies.
Notes: Studies vary from the total of 52 because not all studies reported effect sizes in the domains of language and cognitive processing.
Low IQ-severe RD (N = 13) (IQ M = 96.45, SD = 23.1; Reading M = 84.26, SD = 30.17).
Low IQ-moderate RD (N = 9) (IQ M = 99.21, SD = 30.55; Reading M = 98.12, SD = 14.95).
High IQ-severe RD (N = 8) (IQ M = 112.55, SD = 15.58; Reading M = 81.55, SD = 20.28).
High IQ-moderate RD (N = 13) (IQ M =109.77, SD = 16.85; Reading M = 97.92, SD = 16.85).

Table 9

Aggregated Means and Standard Deviations for the Classification and Comparison Categories as a Function of IQ

	High-Intelligence Studies				Low-Intelligence Studies				
Classification Measures	# Studies	Mean	SD		# Studies	Mean	SD	Difference	Effect Size
Standardized Scores									
General Intelligence	25	110.67	5.31		24	97.79	10.99	12.88	1.58
Verbal IQ	14	110.16	5.71		16	94.14	6.64	16.02	2.59
Reading Comprehension	12	90.03	12.81		16	93.46	6.54	-3.43	-.35
Word Recognition	18	94.38	7.1		16	86.85	10.22	7.53	.86
Effect Sizes Classification	# Studies	Mean	SD		# Studies	Mean	SD	Difference	Effect Size
Reading Comprehension	10	1.25	.62		15	1.27	.63	-.02	-.03
General Intelligence	14	.23	.22		14	.75	.56	-.52	-1.33
Verbal IQ	10	.57	.49		8	.94	.76	-.37	-.59
Word Recognition	14	1.72	.66		14	1.69	.92	.03	.03
Effect Sizes Comparison Measures	# Studies	Mean	SD		# Studies	Mean	SD	Difference	Effect Size
Speed	6	1.34	.52		14	1.19	.96	.15	.20
Phonological Processes	9	1.22	.65		2	.76	.24	.46	1.03
Word Attack	10	1.84	.84		11	1.57	.4	.27	.43
Math	8	.65	.68		6	1.01	.69	-.36	-.52
Vocabulary	4	.72	.76		13	.87	.63	-.15	-.21
Spelling	12	2.02	.61		8	1.68	.85	.34	.46
Writing	2	1.32	1.01		4	1.26	.76	.06	
Social	1	.25	.		2	.13	.02	-	-
Problem Solving	8	.2	.2		10	.4	.52	-2.00	-6.66
Verbal Memory	12	1.36	.54		8	.69	.44	4.00	3.90
Visual Memory	3	.55	.4		1	.79	.	2.00	

	High-Intelligence Studies				Low-Intelligence Studies			
Effect Sizes Comparison Measures	# Studies	Mean	SD	# Studies	Mean	SD	Difference	Effect Size
Perceptual- Motor	5	.83	.77	3	.2	.29	2.00	
General Information	2	.23	.03	3	.57	.34	-.34	
External Criteria	4	.68	.19	2	.46	.19	.22	
Personality	1	2.18	.	2	.72	1	1.46	
General Information	4	.51	.27	2	.54	.59	-.03	
Auditory-Perceptual	1	.2	.	2	.95	.43	-1.00	
Neurological	2	.71	.7	1	.13	.	.58	

Table 10

Psychological and Achievement Profiles on Standardized Norm-Referenced Measures for Adult Participants With and Without Reading Disabilities as a Function of High and Low Intelligence

	High Intelligence				Low Intelligence		
	K	M	SD		K	M	SD
Norm-Referenced							
Word Attack	10	92.89	13.64		11	81.97	7.26
Math	6	101.31	6.14		11	90.02	10.49
Spelling	11	89.88	6.10		11	85.36	12.51
Problem Solving[a]	12	11.94	1.18		17	10.88	1.90
Memory-Verbal[a]	9	7.59	1.91		12	8.54	2.41

[a]Scaled score.

Table 11

Comparison of Studies Separated by Variations in Math Scores and Inclusion of Math Scores

	Conditional Model			
	Cognitive Processes		Language	
Random Effects	Variance	SE	Variance	SE
Intercept	.01	.04	.004	.02
Residual	0		.06	0
Deviance	16.3		2.5	
AIC	63.8		22.5	
BIC	48.9		35.1	
Fixed Effects	Estimate	SE	Estimate	SE
Intercept	1.01**	.10	1.62***	.07
Explanatory Variables				
High vs. Low Intelligence	.38*	.13	.24**	.09
Severe vs. Moderate Reading	.08	.09	-.07	.07
Discrepancy-Intelligence x Reading	.01	.10	.04	.07
ES Intelligence	.14	.30	.23	.20
ES Reading	-.003	.23	.59	.15
ES Intelligence x Reading	.48	.50	-.25	.30
Math Contrast Variable	.44*	.19	.10	.13

** p < .01

Appendix C

Reporting of Studies, Age of Adults with RD, Sample Size of RD, Intelligence Level, Reading Level, Effect Sizes for IQ, Reading (Mean of Word Recognition and Comprehension), Reading Skill (Phonological Processing, Word Attack), Language (Vocabulary, Writing, Spelling), Memory (Verbal and Visual-Spatial), Perception (Motor, Visual, Auditory), and Aggregated Effect Sizes Across All Measures

Study ID	Age RD	Sample #	Gender Ratio	IQ	Reading	ES IQ	ES Read	ES Skill	ES Language	ES Math	ES Memory	ES Perc	ES total
1	18.6	36	.5	95.69	90.94	1.11	2.14	.	2.03	2.04	1.57	.	1.71
2	21.7	40	.72	89.58	95.7	2.05	1.03	.	.68	1.44	.	.	1.32
3	20.54	184	.68	103.57	100.02	.	.	.	.	.	.	.	1.01
4	23.8	16	.55	109.95	67.8	.24	1.64	1.09	2.87	.	.	.24	1.03
5	24.29	61	.7	97.68	90	.79	.	.	.	.	.	.	0.53
6	21.2	35	.43	103.1	88.8	.07	.76	1.02	.67	.	1	.	0.53
7	22	30	.57	105.75	96.2	.	.82	.	.	.	2.7	.	1.56
8	24.1	74	.59	101.56	89.23	.27	.78	.	1.06	.21	.	.	0.53
9	23.79	50	.38	107.19	92.35	.43	2.12	.	.25	.02	.	.	0.65
10	21.12	25	.	101.5	82.5	.	1.35	1	.49	.	.	.	0.79
11	20.68	28	.54	101.5	101.22	.	1.17	1.18	.95	.	.61	.	0.91
12	21.43	30	.6	105	102	.	.51	.	.16	.98	.	.	0.56
13	21.1	15	.	104	104	.	.	.	.	.	.	.	.50
14	21	20	.8	104	93	.	.	.	.	.	.	.	.25
15	24.6	102	.66	85.79	70.22	.01	.69	.	.45	.4	.14	0	0.32
16	29.3	23	.	110.08	85	.17	1.36	.	.	.	.93	1.13	0.89
17	33.5	37	.	95.83	77.5	1.05	2.58	1.93	.	.	.44	1.25	1.33
18	31.4	20	.25	77	97.85	1.08	.55	1.97	.28	.	.57	.	0.69
19	24.8	68	.	98.1	83.4	.8	1.88	2.14	2.23	.	.	.	1.45
20	20.7	43	.56	100	93.9	.81	.	.	.	.	.	.53	0.69
21	20.59	22	.27	112.18	98	.33	.	2.34	.	.	.71	.	0.84
22	41.19	57	.49	117.75	77.48	.06	1.56	.83	2.29	.05	.	.	0.99
23	20.04	11	.82	110	104	.	.	.83	.	.	.63	.	0.73
24	25.27	50	.54	100.86	68.74	.41	.	.	.	.	.	.	0.41
25	18.8	20	.9	103.55	89.8	1.1	1.3	1.5	1.64	1.2	.	.08	1.08
26	34.4	10	.	118.63	92.8	1.01	2.67	3.53	2.31	.	.	.	1.88

Study ID	Age RD	Sample #	Gender Ratio	IQ	Reading	ES IQ	ES Read	ES Skill	ES Language	ES Math	ES Memory	ES Perc	ES total
27	32.1	26	.62	91.5	89	.	1.55	1.48	1.86	.	.82	.	1.28
28	24	13	.54	103	97.5	.	2.18	.	.	.	.	.	1.69
29	31	22	.45	105	100	.07	1.53	2.1	1.05	.	.66	.	1.15
30	39.97	37	.49	111.04	91.04	.18	.85	.86	.96	.	.	.	0.65
31	20.5	18	.33	100.44	91.97	.24	1.4	.	.9	.	.	.64	0.94
32	33.97	13	.	97	91	.	1.97	1.99	2	.78	.4	.	1.4
33	22.29	14	1	104.07	79	.55	1.5	.	.	1.92	.	.41	0.86
34	21	19	.63	112.16	96	.01	.	.	.	.85	.	.	0.43
35	23.9	19	.47	115	105.5	.	1.93	.22	.95	.	1.59	.	0.95
36	23.6	17	.24	111	90	.47	.	1.5	2.07	.	1.56	.	1.54
37	21	20	.4	115	104	1	1.59	1.88	2.13	.	1.2	.	1.37
38	19.1	22	.45	101.1	103.63	.16	.69	.	.74	.	.	.	0.47
39	22.17	17	.	116.79	81.63	.	2.13	2.14	2.08	.	1.33	2.06	1.76
40	19.61	17	.	100.7	81.29	1.46	3.52	.	.	.	.	.	2.49
41	27.9	19	.53	114	94	.	3	.	2.41	.	1.86	.	1.93
42	20.86	35	.	98	85	.	1.92	.	.94	.	.	.	1.43
43	39.56	18	.	110.01	96.56	.1	1.22	1.97	.	.	.	.	1.09
44	22.3	19	.	123.79	96.95	.54	1.39	1.36	2.23	.	1.2	.26	0.94
45	24.76	21	.48	99.38	89.72	.	1.62	1.08	.	.	.	.	1.08
46	33.8	24	.	115.2	92.4	.19	1.59	.83	1.37	0	.	.	0.66
47	26.94	16	.25	108.24	90	.6	1.02	1.13	.	.28	1.3	.	0.68
48	18	39	.51	100	93.2	.	1.21	1.54	1.74	.	.	.	1.45
49	24.8	21	.81	79.68	84	.	.	.	.	.	.	.	.20
50	22	51	.67	105.75	102	.	1.32	.	.	1.09	.	.	1.02
51	19.05	20	.65	98.27	88.75	1.32	2.41	.93	1.58	.	.79	.	1.38
52	19.9	11	.45	104.72	90	.	.	.	1.13	.	.	.	0.65

Note: Dots for ESs reflect missing values—e.g., SD not reported within study.
Positive ESs in favor of adults without RD. IQ = intelligence (verbal and general), Read = reading (word recognition and comprehension), Mem = memory (verbal and visual-spatial memory), Per = perceptual (motor, visual, auditory), Total = mean aggregate effect size for study without classification measures.

Chapter 3
Issues in Identifying Learning Disabilities for English Language Learners

Robin L. Schwarz

Introduction

According to the Office of Vocational and Adult Education (OVAE)[1], there are more than 1.2 million adult English language learners (ELLs),[2] comprising 44% of the adult learner population, in federally funded adult basic education (ABE) or adult secondary education (ASE). At least 11 states report that ELL enrollment in adult education accounts for 50% or more of learners—with California and Nevada having more than 70%. Science estimates the rate of learning and/or reading disabilities to be approximately 6%–20% in the general population[3] (a figure that varies according to institution, expert, and method of identification [Shaywitz et al., 2003]), so we know among that huge population of ELLs are many who struggle with learning disabilities. Knowing **who** they are is another question. "The challenges that must be surmounted before truly effective identification of English language learners with learning disabilities is possible are daunting..." (Wagner, Francis, & Morris, 2005, p. 6).

> Identification of English language learners with learning disabilities is hampered by a lack of theory and empirical norms that describe the normal course of language and literacy development for English language learners and the individual, school and social factors that relate to that development. The context provided by profound differences in the nature of prior schooling cannot be ignored (p. 13).

Adding to the complications of prior schooling is

> …the interplay between language and learning for [learners] who are learning in a second language. For these [learners] it is unclear whether limited language proficiency in English is interfering with learning or is masking a learning disability, or leads to poor performance on assessments used for identification, which are not culturally and linguistically appropriate for that purpose (Wagner et al., 2005, p. 6).

1. http://www.ed.gov/about/offices/list/ovae/pi/AdultEd/aedatatables.html
2. In this review, ELL refers to the persons who are learning English; English for Speakers of Other Languages (ESOL) refers to the field, which serves adult ELLs in adult education settings, not in higher education or private language learning schools.
3. http://ncld.softsourcecorp.net/content/view/448/391: 5%+ of child population in school has LD.
http://www.nichcy.org/Disabilities/Specific/Pages/LD.aspx: 1 out of 5 people have LD.
http://www.interdys.org/FAQHowCommon.htm: 15%–20% of general population has language-based LD.

With these limitations in mind, the purpose of this chapter is to examine existing literature around the issues in identifying learning disabilities (LD) in adult English language learners. Because of the attention of educators to the issues mentioned by Wagner et al. (2005) and to the disproportionate referral of culturally and linguistically different students to special education in K–12 in the United States, considerable literature has been generated around younger ELLs and learning or reading disabilities. Out of those concerns has grown another body of research exploring alternative ways to evaluate language learners, especially ways not involving reading of text. This literature has been generated in an attempt to explore the possibility of common underlying processes in reading and phonological skills that could be the focus of testing for learning difficulties. Other researchers question that hypothesis and have attempted to demonstrate the language-specific nature of some aspects of reading, phonological, and other skills, a factor that would preclude using a universal testing approach. An extremely small portion of this research has focused on adult language learners, and an even smaller number on adult ELLs. As Wagner et al. note, the issues involved in evaluating adult ELLs are complex.

What can be gained from this literature review is an appreciation of that complexity. Little light is shed on the possibility of accurately and effectively identifying in adult ELLs what are known as LD in our (U.S.) culture, or even reading disabilities (RD) across languages. Instead, the need for understanding as much as possible about each learner and what might be causing him or her to struggle in learning is the real finding of this literature.

Literature Search

The extremely wide variety of fields and topics that bear on the question of direct testing of ELLs for LD/RD required a multifaceted search. The search was conducted with variations and combinations of the following terms. (Adult) English language learners (ELL)/English as a second language (ESL)/English as an additional language (EAL)/English as a foreign language (EFL)/learners of English/nonnative speakers of (NNS)/learners learning (another language)/bilingual/bilingual learners and learning difficulties

- (Adult) (second) language acquisition (SLA)/language learning/foreign language learning (FLL)/foreign language learning difficulties (FLLD)
- Critical period/adult language acquisition/grammatical sensitivity/grammaticality/phonological sensitivity/auditory processing
- Morphology/morphological sensitivity/morphological awareness (MA)
- Pronunciation/articulation/language impairment/language proficiency/specific language impairment
- Linguistic/cross-linguistic/cross-language transfer
- Learning disabilities (LD)/learning difficulties/core deficits
- Reading disabilities (RD)/reading impaired (RI)/reading impairment/dyslexia/dyslexic/exceptional learners/culturally and linguistically different learners (CLD)
    - Diagnosis of LD/RD/diagnostic/diagnostic testing
    - Discrepancy model/intelligence testing/achievement tests
        - Assessment/language-based assessment

- Terms related to reading and reading assessment
- Phonological skills/phonological awareness (PA)/ phonemic awareness, phonological processing skills/syllable awareness/phonological memory (PM)/phonological loop/nonword/nonsense word/nonsense word repetition
  - Decoding/decoding fluency/word naming/ word reading/word recognition/letter naming/orthographic processing/reading fluency
  - Rapid automatized naming (RAN)
  - Rhyme/rhyme sensitivity/onset-rime awareness
  - Orthography/orthographical awareness/ orthographic fluency/ orthographic skills
- Literacy/literacy acquisition/biliteracy/biliterate

The search included journals that typically publish on relevant topics: *Dyslexia, Journal of Learning Disabilities, Annals of Dyslexia, Journal of Experimental Child Psychology, Applied Psycholinguistics, Modern Language Journal, Brain and Language,* and *Learning Disabilities: Research and Practice.* The search included the names of prominent researchers in various fields—for example, Geva, McBride-Chang, Segalowitz, Siegel, and Sparks, among others. The search included bibliographies/references of works of prominent researchers and topics that emerged as relevant to topics being reviewed—for example, RAN, reading fluency, and illiterate adults.

View of the Research

Studies and literature included met the following criteria in this order:

I. Literature relevant to the questions
   a. Literature that directly addressed one of the two research questions
      i What evidence indicates that it is possible to do some kind of direct testing of adult ELLs for LD or RD?
      ii. What evidence indicates that such testing is not possible?
   b. Literature that indirectly supported one of the questions posed in the Introduction
      i. Language-learning difficulties
      ii. Reading processes in other languages
      iii. Identification of RD/LD in other languages or cultures
      iv. Language-learning processes of adults
      v. Other factors relevant to direct testing of ELLs for LD/RD

II. Literature published in a peer-reviewed journal
   a. Articles in foreign journals (without regard to whether review or publication standards were equivalent to those of U.S.-published journals)
   b. Articles from a wide range of fields (without attempts to ensure intrafield or intracountry consistency in terminology, methods of research or analyzing and reporting on research, standards of sample size, or validity of conclusions)

III. Literature not published in peer-reviewed journals (because of the paucity of literature concerning adult ELLs or adult language learners, some exceptions were made to the criterion of publication in a peer-reviewed journal)
   a. Dissertations accepted for degree conferral but unpublished
   b. Studies produced for professional research organizations (technical reports)
   c. Reviews of literature that had direct bearing on the topic, and that were done by researchers

whose studies were included elsewhere in the review
d. A report on testing of adult ELLs done by professional diagnosticians

IV. Studies comprising the following
a. Quantitative, and findings reported had statistical significance
b. Qualitative, supporting the discussion specific issues concerning adults
c. Research reviews of quantitative research

V. No limitations were imposed as to the following
a. Size of study
b. Age or type of subjects
c. Language or languages of subjects or testing
d. Type of study (e.g., experimental vs. descriptive, etc.)
e. Setting of study (i.e., classroom vs. laboratory)
f. Country of location of the study

VI. Subjects referred to in three age categories
a. Adults = learners of postsecondary age (older than 18 years) (adults, college students, adult volunteers in studies)
b. Older school-age learners = subjects 11–17 years old or fifth school year and above
c. Young learners/children = subjects 10 years or younger; up through fourth year of school

Report of Findings–Part I: Key Concepts and Definitions of Language Processing and Reading[4]

PHONOLOGICAL SKILLS

Phonological skills are those fundamental language skills underlying literacy and language acquisition (Baddeley, Gathercole, & Papagno, 1998). In the sense that every language is made up of sequences of sound chunks and speakers of languages have a greater or lesser awareness of these features, phonological skills are universal. Phonological skills both precede and support text-related skills. That is, the greater proportion of these skills do not depend on text, but without the awareness of the relevant units represented by the text system of a language, a learner will have great difficulty acquiring text-based skills.

Phonological skills, as described and studied by Baddeley et al. (1998), comprise two subsystems, phonological awareness and phonological memory.

Phonological Awareness

PA is the sensitivity to sound chunks (words, syllables onset-rimes, and phonemes) in one's language and the ability to identify and manipulate those chunks and sound patterns. While all languages have words and syllables, not all languages have the same syllabic structure. Similarly, alphabetic languages use individual phonemes to create words, and manipulate the phonemes makes new words; other languages may not be organized on the phonemic principle, but awareness of such features as first sound (phoneme) in words or syllables, and syllables in words extends across languages (Tan, Spinks, Eden, Perfetti, & Siok , 2005).

In English, weak phonological awareness in children and adults is strongly correlated with failure to read fluently or at all, and, conversely, persons with strong reading and spelling skills have highly

4. Because of the number of abbreviations used in this chapter, a Glossary is included at the end of this chapter.

developed phonological awareness. This relationship was assumed to be similar in all languages, but research now tells us it is not (Everatt, Smythe, Ocampo, & Gyarmathy, 2004; Tan et al., 2005).

Phonemic awareness. Phonemic awareness is a subskill of phonological awareness. In every language, speakers develop awareness of initial sounds of words, but awareness of sounds within words depends on the language. In languages in which writing represents only syllables or whole words, further phonemic awareness does not develop; however, in alphabetic languages, this skill develops fully as literacy develops and the learner understands how individual letters represent the sounds in a word. This skill develops much more slowly in English, where the sound-symbol relationship is irregular in many ways. Phonemic awareness appears to depend heavily on degree of education or literacy (e.g., Reis & Castro-Caldas, 1997).

Measurement of PA and phonemic awareness. PA and phonemic awareness are measured with a variety of tasks in which the learner identifies or isolates words, syllables, or phonemes. Though the principles are the same from language to language, tasks must be language specific, since languages have different phonological structure.

Phonological Memory

PM, the other major phonological skill, is the ability to remember novel (i.e., never heard before) sounds or strings of sounds and either repeat them or move them to longer-term memory. It is a key skill for acquisition of vocabulary and oral skills and, therefore, is seen to play a significant role in foreign language learning. Some studies have found a strong relationship between PM and reading attainment in both the first and second language (Sparks, Patton, Ganschow, Humbach, & Javorsky, 2006), possibly because the strength of PM predicts vocabulary development (Baddeley et al., 1998).

Measurement of PM. PM is usually measured by having the learner repeat nonsense words of increasing length. Several factors such as word length, consonant clusters, resemblance of nonwords to real words, syllable repetition, and whether sounds or combinations of sounds in the words exist in the subject's language influence how well the learner may repeat such words. PM is stronger in one's primary language because the brain has a vast store of words and sounds from that language. PM will be less robust in a new language, and a key question in testing PM is whether to test in the new language or in the primary language. As for phonemic awareness, PM is apparently increased by education (Reis & Castro-Caldas, 1997). This is yet another area where few realistic norms exist for learners of different ages and language backgrounds, especially if the person in question is multilingual.

Orthography

Orthography refers to the writing system a community uses to represent its spoken language. Orthographies are described as shallow or transparent if there is a direct and constant relationship between sounds and symbols, making reading and spelling highly predictable and easy to learn.

Orthographies in which the relationship is not constant and predictable, such as English or French, are referred to as deep or opaque (Geva & Siegel, 2000). There is an extremely wide variety of ways in which orthographies represent—or do not represent—the sounds of the spoken language of a community. One extreme is the alphabetic system, where one symbol represents one sound (phoneme) and sounds can be assembled into endless numbers of words. On the other extreme is the logographic system, where whole words and ideas are represented by one symbol, albeit a complex one. In between are many other methods of representing sound with written symbols. While the basic process of assigning sound and meaning to writing—that is, reading—is fundamentally similar, research now tells us that very large differences can exist in how the brain achieves

this process in different languages and how readers and writers learn and use the systems.

Orthographic processing. Spelling and reading require visual processing as well as sound processing. Orthographic processing (OP) refers to a learner's ability to assign sound to symbol (reading) or symbol to sound (spelling) accurately and fluently (Geva, 2000). The speed and accuracy with which a reader processes orthography is closely correlated with how well the larger task of reading proceeds.

Measurement of orthographic processing. OP is measured by spelling, judging whether spelling patterns are possible, matching sound to possible spelling patterns, and reading words rapidly (Geva, 2000). The letter-naming task of rapid automatized naming is also considered orthographic processing (see below).

Rapid Automatized Naming

RAN refers to a task where a learner must name, as quickly as possible, five to seven randomly repeated pictures of items, numbers, color squares, or letters arranged in four or five rows. This skill has very high correlation with fluent reading. The theory is that it embodies the rapid retrieval of visual and phonological information needed for fluent reading, though not all researchers agree on the underlying mechanisms of it. Times for repetition of various types of items vary enormously; depending on the phonological structure of words for the items in different languages, times for the task will also vary in different languages. Letter naming is thought to be most closely related to reading of all RAN tasks (Wolf, Bowers, & Biddle, 2000).

Report of Findings — Part II: Theories Referred to in the Review or Underlying Research

THEORIES OF READING DIFFICULTY

Central Processing Hypothesis

According to the central processing hypothesis (CPH), reading processes are fundamentally the same—mapping sound and meaning onto visual symbols—and therefore, reading problems should have a common basis (Geva & Siegel, 2000). The theory is supported by the extensive research on foreign language learning difficulties (primarily on speakers of English learning foreign languages), which proposes that core processing difficulties in a reader's native language are causally related to problems in acquiring reading skill in a new language (e.g., studies of Sparks and others; see Sparks in references section) and by studies showing that phonological processing weaknesses cause similar reading difficulties in different languages (see studies by Sparks and colleagues). The theory is also supported by some neuroscience that indicates that the basic process of mapping sound to symbol in the brain is largely the same in any orthography (Pugh, Sandak, Frost, Moore, & Menel, 2005).

Script-Dependent Hypothesis

The script-dependent hypothesis (SDH) is connected to the concept of depth of orthography. According to the SDH, the degree to which the language is deep or opaque is seen to contribute directly to the degree of reading problems (Geva & Siegel, 2000). This theory has been strongly supported by recent research showing that while the concept of orthographic processing is generally similar across languages, many features of orthographic processing are language specific and orthographic processing skills do not transfer to a new orthography as readily as previously supposed (Bialystok, McBride-Chang, & Luk, 2005; Wang, Park,

& Lee, 2006). Neuroscience has supported this theory in showing that the brain is literally shaped by the language in which a learner learns to read (Tan et al., 2003), which means that dyslexia is then different in different orthographies due to different pathways being used in the brain (Shu, Meng, Chen, Luan, & Cao, 2005; Ziegler, Perry, Ma-Wyatt, Ladner, & Schulte-Korne, 2003). Thus, a competent reader of Korean who reads slowly in English is most likely doing so because he or she has to learn a new way of reading script, not because of problems reading per se (Wang et al., 2006).

LANGUAGE ACQUISITION THEORY

Universal Grammar or Common Underlying Proficiency

One major school of thought in language acquisition is that the human brain has a natural ability to develop oral language and organize grammar and syntax (Bishop, 2000; Opitz & Friederici, 2004). This ability is now thought to be viable up to about age 10, after which, if it is not activated, language skills will not develop. It is this theory that explains why young children can generate sentences they have never heard before and why they relatively quickly organize oral input into a language system and then refine it to match the community the learner is in (Bishop, 2000). Neuroscience supports this theory in showing that young brains are highly plastic and can process new sounds easily (Kuhl, 2000). Much disagreement exists in language acquisition communities about the degree to which language acquisition is natural or mediated or both (Birdsong, 2006).

Critical period. The other side of the universal grammar theory is that after a certain age—or brain maturity—language is no longer acquired "naturally" and must be acquired consciously and with effort, if at all. Neuroscience supports this theory to the extent that it has been demonstrated that mature brains do not process sound efficiently and cannot perceive or command speech gestures in a new language as purely as those of native speakers of a language (Kuhl, 2000). The theory is also supported by the fact that if a learner is multilingual before the end of the critical period, subsequent language learning is not as difficult as it is for monolingual learners (Kuhl, 2000). Little disagreement exists about the fact that language acquisition for persons past the optimal language learning age is effortful and conscious (Birdsong, 2006; Segalowitz & O'Brien, 2007).

Basic Oral Communication Skills and Cognitive Academic Language Proficiency

A refinement of the language acquisition process theorized by Cummins (1984) is that not all types of language are acquired at the same rate. According to this theory, basic interpersonal communication skills (BICS), or oral language used in highly contextualized situations, are acquired relatively quickly—in about 1–3 years in adults. In contrast, the vocabulary and understanding of language complexity needed for reading texts, forms, directions, and other less contextualized material requires a much longer time to acquire. Some researchers maintain that it may take as long as 10 years for an English language learner to acquire this cognitive academic language proficiency (CALP) to a level where she or he can compete with native English speakers in materials written by and for native English speakers (Collier, 1995; Hakuta, Butler, & Witt, 2000).

DEFINITIONS OF DISABILITIES

The literature findings in this chapter use a wide range of terms for various learning difficulties. The following are compilations of definitions used in the literature:

Foreign Language Learning Difficulties

Foreign language learning difficulties (FLLD) refer to problems with any aspect of language learning, especially

those needed for foreign language classes: grammar, accurate speech, reading comprehension, and so on.

Phonological Processing Difficulties

Phonological processing difficulties are problems with both or either phonological awareness or phonological memory in the first or new language. These skills are variously found to correlate with reading difficulties or not.

Learning Disabilities or Specific Learning Disabilities (SLD)

These are learning difficulties legally defined and labeled subsequent to diagnostic testing, usually through use of the discrepancy model between ability and achievement (for adults).

Reading Disability

Reading disability is inconsistently used in the literature to refer to difficulty in reading sufficient to cause the learner to be unsuccessful in school or learning, or to be seen as functioning below grade or age level in reading. This term most often refers to difficulty in reading words efficiently with resulting difficulty in processing meaning. Comprehension difficulties are referred to as such. *Reading impaired* is used synonymously with RD.

The term *dyslexia* is used in only a few studies in its clinical meaning of inability to achieve fluency in assigning phonological sound to symbols, resulting in slow or labored decoding, and possibly slow processing of content information.

Report of Findings — Part III: Introduction to Evidence Supporting Direct Testing of ELLs for Learning Difficulties (RD/LD)

The primary line of investigation about direct identification of LD or RD in ELLs has grown out of research on English-speaking learners who have had difficulty in learning a foreign language (FL).[5] This research proposes that core processes that are impaired in the native language (NL) (also called L1)[6] will cause similar processes in the FL to be impaired as well. Thus, following that premise, it should be possible to identify LD in a learner's NL, FL, or target language (TL).[7] This section reviews research attempting to prove that this is a viable approach to identification of LD or RD in language learners.

Report of Findings — Part IV: Native Language Skill Weaknesses and Foreign Language Learning Problems

The premise that FL learning difficulties have their roots in NL weaknesses, particularly phonological processing skills, has been stated in the Linguistic Coding Difference Hypothesis (Sparks & Ganschow,

5. Foreign language refers to a language studied as a subject.
6. Native language refers to a learner's dominant language. Though many adult learners speak many languages, it is the dominant language that is of interest. This term makes no assumptions about whether the reader reads and writes this language in addition to speaking it.
7. Target language refers to a language the learner is learning for purposes of communication. This term is used instead of ESL or second language because (a) many adult ELLs speak two or more languages before learning English and the fact of multilingualism must be kept constantly in mind; (b) a number of the studies referred to in this review concern learners of target or foreign languages other than English.

1991). "If phonological problems cause difficulties with FL learning, both oral and written, then it seems plausible to speculate that phonological difficulties are likely to cause oral and written language problems in L1" (Sparks & Ganschow, 1993, p. 295). FL learning difficulties (FLLD) include problems in decoding, phonological processing skills such as phoneme identification and segmentation, word and letter naming, and working memory. Sparks, Ganschow, and others have repeatedly documented the connection between weaknesses in NL skills and FL learning difficulties through testing NL (English) skills of college and high school FL learners who were unsuccessful in FL learning (Ganschow & Sparks, 2001; Sparks & Ganschow, 1993; Sparks et al., 1998; Sparks, Ganschow, Javorsky, Pohlman, & Patton, 1992; Sparks et al, 2006). Downey, Snyder, and Hill (2000) also documented significant weaknesses in NL phonological skills in 55 learning-impaired (through previous diagnosis) college FL learners and no weaknesses in phonological skills of 34 nonimpaired counterparts in FL courses.

The NL-FL relationship was most clearly demonstrated in a longitudinal study conducted by Sparks and Ganschow and others with 52 learners who were tested four times between their first and 10th years in school. As their other research indicated, NL weaknesses not only were strongly correlated with later FLLD, but also a number of these weaknesses were strong predictors of those difficulties (see below for more discussion of factors that predict difficulty) (Sparks et al., 2006).

Report of Findings — Part V: Direct Testing to Identify RD, LD, or FLLD (Table 12)

If the relationship between NL skills and target language skills is accepted, then testing for learning difficulties can be done either in the NL, the FL/TL, or both languages, or by testing a specific language-related skill in one or the other language. We have seen that testing in NL identified significant weaknesses in learners who had FLLD.

GENERAL TESTING TO IDENTIFY LEARNING DIFFICULTIES

Testing in Both Languages

In a review of previous empirical research on language transfer and the transfer of phonological skills, Durgonoglu (2002), asserts that learning difficulties in target language learners can be distinguished from normal language acquisition issues by measuring learners' phonological skills in both languages. Two studies on adult language learners examined this approach. Both of these studies were small, but the findings were robust.

Ijalba (2008) tested 60 adult Spanish-speaking ELLs on reading, spelling, and phonological processing tasks in both languages. Learners had also been asked to rate their success in acquiring English skills. Those students reporting difficulty in English literacy acquisition had Spanish language weaknesses in phonological awareness, decoding, and spelling that were correlated significantly with severe to moderate difficulty in learning to read and write in English. Those reporting no difficulty in learning English had corresponding strengths in NL skills. The differences in scores in Spanish skills were statistically significant between groups, as were differences between the poor readers and the successful readers in English.

Weak phonological skills in both L1 and the TL were similarly documented in 32 Mandarin-speaking Chinese learners in a Canadian ESL program, though the L1 findings were weak. Learners were tested on nonword repetition, reading (decoding), and word-naming tasks in both Chinese and English. As in the Ijalba study, strengths and weaknesses in phonological skills in one language were generally mirrored in the other. The phonological processing measures had a cross-linguistic relationship. Those students previously identified as at risk for problems in reading in English had scores significantly different from the scores of non–at risk readers on several English measures as well as one L1 measure (Harrison & Krol, 2007).

Meschyan and Hernandez (2002) similarly confirmed that weak skills could be found in both languages of college FL learners tested in both their languages. Weak skills in both L1 and the FL were formally documented in older school-age learners as well (Crombie, 1997 (French/English); Helland & Kaasa, 2005 (Norwegian/English)); and in younger learners with various L1 and TLs (Chiappe & Siegel, 1999; Cisero & Royer, 1995; Everatt, Smythe, Adams, & Ocampo, 2000; Geva, 2000; Geva, Yaghoub-Zadeh, & Schuster, 2000; Geva & Yaghoub-Zadeh, 2006; Gholamain & Geva, 1999; Kahn-Horwitz, Shimron, & Sparks, 2006; Leafsted & Gerber, 2005; McBride-Chang et al., 2005; Swanson, Saez, & Gerber, 2004, 2006; Wang et al., 2006).

In terms of relevance of these studies for this review, it should be noted that this testing was possible in languages and settings where fully developed tests are available.

Testing in the TL Only

Testing for learning difficulties in the learner's TL is the ideal condition for adult English for speakers of other languages (ESOL) programs in the United States since testing in L1 is often impractical due to a lack of tests and qualified examiners and also to the wide range of languages in many programs. Furthermore, if the learner's first language is unwritten, testing of reading or writing skills in that language cannot even be contemplated. In the following studies, learners' phonological skills were tested in their TL only.

Frederickson and Frith (1998) provided foundation evidence that phonological skills could be measured in the TL only. Their subjects were a small group of Sylhetti speakers 10–11 years old with less developed reading and writing skills than those of their English-speaking peers. Testing showed that despite overall lower literacy skills in English, Sylhetti-speaking learners who had amounts of schooling similar to their English-speaking peers had similar phonological skills. Thus, researchers posited that reading problems were related to normally lagging reading vocabulary, not to core phonological weaknesses—a finding consistent with the theory that acquisition of the academic language needed for reading takes more time to develop than does the language for oral/aural skills. (See Part I, Key Concepts and Definitions of Language Processing and Reading, and the next section of the literature review for more discussion of this issue.)

Everatt, Smythe, Adams, and Ocampo (2000) tested other young Sylhetti-speaking children in general education settings in England. One group of the learners previously identified as having specific learning disabilities had scores on measures of English phonological processing (nonword reading, rhyme detection) significantly different from those of their nondisabled bilingual and monolingual peers but similar to those of monolingual peers identified as having learning problems.

Because Sylhetti is a nonwritten version of Hindu and these learners did not read or write their first language, the findings of these two studies may be relevant to the evaluation of nonliterate adult ELLs whose L1 is also unwritten.

Testing in the TL similarly identified phonological processing weaknesses in younger speakers of Bahasa Malaysia struggling in learning English (Gomez & Reason, 2002), in younger learners of Dutch with a

variety of L1s (Jongejan, Verhoeven, & Siegel, 2007), and in younger learners of English with a variety of L1s in England (Hutchinson, Whitely, Smith, & Connors, 2004) and Canada (Lesaux, Rupp, & Siegel, 2007). In a review of a number of studies of ELLs in Canada, Lipka, Siegel, and Vukovic (2005) conclude that RD in young ELLs can be identified by testing phonological skills and that ELLs are not more at risk for RD than non-ELLs.

It should be noted as well that by confirming that weaknesses could be identified in the two languages of the learners in their study, Harrison and Krol (2007) explicitly intended to demonstrate that testing could successfully be done in English to pinpoint weaknesses related to reading problems in adult ELLs.

Specific Tasks That Identify or Predict Learning Difficulties in FL or TL Learners

Within the general testing of phonological and other language-related skills, a number of specific tasks emerge in the literature as being correlated with reading or learning difficulties in FL or TL learners. The factors that are most robustly supported by evidence from studies as having a strong correlation with reading difficulties are phonological memory (PM), orthographic processing (OP), and rapid automatized naming (RAN).

Phonological memory. Three important findings for this review about PM, as measured by nonsense word repetition (NWR) (see Part I, Key Concepts and Definitions of Language Processing and Reading), are found in the literature. First, the relationship of PM to success or difficulty in target (foreign) language learning is robust in adults (Downey et al., 2000; Harrison & Krol, 2007; Ijalba, 2008; O'Brien, Segalowitz, Collentine, & Freed, 2006; Segalowitz & O'Brien, 2007; Sparks et al., 2006). Then, weak PM in L1 *predicted* problems in FL or TL learning in empirical studies of younger learners (Cheung, 1996; Dufva & Voeten, 1999; Papagno & Vallar, 1995; Papagno, Valentine, & Baddely, 1991; Service, 1992; Service & Kohonen, 1995). The longitudinal study of Sparks et al. (2006) showed that weak PM in younger learners was predictive of FLLD when these learners were in high school. Finally, weak PM did *not* differentiate between speakers of different languages as was previously thought, but did differentiate between poor and good readers across languages (Ziegler et al., 2003). In their study of German- and English-speaking subjects 11–13 years old, Ziegler et al. found that the correlation between PM and reading in L1 was significant regardless of the subjects' language background and that, consequently, poor PM identified poor readers equally in both languages, but did not differentiate German from English speakers.

Orthographic processing. Sparks, et al (2006) state that the relationship of NL reading and spelling skills (orthographic processing) to skill in FL learning remains strong through the school years and consistently explains the greatest variance in later outcomes in FL learning. In three studies on adult ELLs, difficulty on word reading, spelling, and other tasks of OP in both languages was related to learners' having difficulty learning English (Harrison & Krol, 2007; Ijalba, 2008; and Nassaji & Geva, 1999).

Difficulty with OP differentiated learners with dyslexia from those with no reading problems in a study of 40 12-year-old Norwegian ELLs, 20 already identified as dyslexic and 20 as nondyslexic. On a variety of tasks presented in English only, the tasks that most clearly differentiated the two groups included spelling in English (OP) and making morphological judgments (Helland & Kaasa, 2005). The relationship of OP to FLLD was similarly documented in college students (Downey et al., 2000; Meschyan & Hernandez, 2002; Muljani, Koda, & Moates, 1998; Sparks, et al., 1992, 1998) and in young FL learners (Al Mannai & Everatt, 2005). In young learners, poor OP in L1 was *predictive* of difficulty in learning English (Geva, 2000; Geva & Yaghoub-Zadeh, 2006; Hutchinson et al., 2004; Kahn-Horwitz, Shimron, & Sparks, 2006).

Rapid automatized naming. The relationship of RAN to reading skills appears to be similar in readers in L1 and in their TL. Nassaji and Geva (1999) found a strong contribution of RAN to reading efficiency in 60 Farsi-speaking adult readers of English as a second language. Borokhovksi, Segalowitz, and LaCroix (2004) explored the relationship of RAN to reading skills in language proficiency in adults of two different language backgrounds and found the relationship between fluent reading and letter naming strong, though they questioned the underlying mechanism. They suggest further research to find out to what degree the *level* of reading fluency influences the RAN scores. In several other studies, young learners' skill with RAN (various tasks) predicted language learning and FL/TL reading proficiency (Geva, 2000; Geva & Yaghoub-Zadeh, 2006; Geva et al., 2000; Gholamain & Geva, 1999; Jongejan et al., 2007; Penney, Leung, Chan, Meng, & McBride-Chang, 2005).

Other Skills Correlated With Target Language Learning

Other skills were found to correlate with language learning, but the literature did not offer plentiful evidence of the relationship.

Working Memory. Working memory (WM), different from PM, explained the largest variance in later reading skill attainment in L2 in adult learners in one study (Nassaji & Geva, 1999), and WM in L1 was the strongest predictor of later reading in child learners in three studies (Gholamain & Geva, 1999; Swanson et al., 2004, 2006).

Receptive vocabulary, listening comprehension, and reading skills in L1. Sparks et al (2006) included what they characterized as NL oral skills as among the strongest NL predictors of later FL proficiency in high school students, while Ijalba (2008) found that these skills correlated with the level of difficulty of learning English reported by the adult ELLs studied. Ijalba also found that this relationship reached statistical significance in those learners with very limited education in L1 who reported difficulty in acquiring literacy skills in English. This finding illustrates the necessity of determining a learner's L1 literacy level when difficulties in learning to read or write in English arise.

Listening comprehension and reading skills in the target language. More important for evaluation of ELLs than the L1/oral skills correlation was the finding that listening comprehension and receptive vocabulary in the FL/TL were positively correlated in young learners (Geva, 2000; Geva & Yaghoub-Zadeh, 2006).

Oral skills and reading in both languages. Features of productive oral language such as syntax, vocabulary diversity, general language proficiency, and narrative structure in both languages were positively correlated to reading in both languages of young Spanish-speaking ELLs (Miller et al., 2006). This finding is of interest in relation to evaluation of nonliterate adult ELLs acquiring reading skills in English. Evaluation of their oral skills may provide a better picture of how their reading skills develop.

Speech perception. Poor speech perception was one of a number of differentiating factors in the longitudinal study of NL predictors of Sparks et al. (2006). In two other studies, language learners' perception of speech sounds was found to correlate with reading difficulties and differentiated poor readers from good readers. Those who were poor readers had significantly poorer speech perception than good readers (Ortiz et al., 2007). These studies confirm the study of monolingual English speakers reported by Ahissar, Protopapas, Reid, and Merzenich (2000), who found that acoustic difficulties are retained into adulthood and contribute to reading difficulties. Poor auditory processing clearly differentiated poor readers from good readers in this study of 102 adults.

This is another finding that has implications for evaluating nonliterate adult ELLs, for whom text-based tasks are not possible. It could also be of interest for evaluating literate ELLs, as it focuses on a core language-learning issue (see the discussion below of adult language learning).

Morphological awareness. Studying a large sample (1,083) of young ELLs and native English speakers, Siegel (2008), found that MA (classification of words, sensitivity to correctness of words in sentences presented auditorily) discriminated among dyslexic and nondyslexic readers in L2 regardless of their language background.

McBride-Chang et al. (2005) found that although the relationship between MA and PA was not the same in Chinese, Korean, and English, it *was* consistent *within* each language. Therefore, a poor relationship of MA to PA in individual learners identified learners at risk for reading problems in those languages, underscoring the role of MA in reading. These two findings are important here because the MA sensitivity differentiated learners with reading difficulties.

Other Routes to Identification of Learners with Learning Difficulties

Four other approaches to identification of learners with learning or reading difficulties appeared in the literature. Most interesting of these is the following:

Non–test-based teacher evaluation of adult ELLs. In the studies of Harrison and Krol (2007) and Ijalba (2008), teachers were provided information about adult language learning, reading development, and other topics that would help them distinguish learners with normal learning issues from those with possible learning problems. When teachers used the information and guidelines developed from it, their identification of learners with difficulties correlated significantly with findings from testing in both studies. This contrasts sharply with the findings of Limbos and Geva (2001), who concluded that the judgments of teachers that very young ELLs probably had learning problems were highly inaccurate because the teachers were making such judgments based on erroneous beliefs about language acquisition.

These findings about improved accuracy of teacher judgments as a result of teachers' having information to make informed judgments have strong implications for adult ESOL, where teachers often believe learners have some learning impairment but have no basis for such a decision. This approach avoids almost all the complicating issues that direct testing poses (see the second half of the review for a complete discussion of these issues).

Testing language-learning potential with a pseudolanguage. In an explicit attempt to bypass the discrepancy model of identification of LD, Dwairy (2004) developed a dynamic assessment tool, the Dynamic LD Test (DLD), which evaluates how a learner learns to read, write, analyze words, and generate new ones by testing these processes through use of a few words and symbols in a "new" (i.e., artificial) language. An experimental study showed that learners were more finely categorized by this tool than by discrepancy classification, and learners identified by the DLD as *not* having genuine LD made progress in learning, given adequate intervention, contrary to the predictions of the discrepancy model findings (Dwairy, 2004). This approach to language learning is similar to that of the Modern Language Aptitude Test (MLAT) used frequently by Sparks and Ganschow and colleagues in their studies and found over decades to be a strong predictor of FL learning, though the MLAT does not purport to identify LD. The application of this approach for evaluating adult ELLs is that is that Dwairy's tool uses an artificial language and symbols, bypassing many of the problems of culture, real language, and orthography present in traditional testing for language learners, and focusing on core language-learning strategies.

Measuring processing in the brain. Two studies report on different ways of measuring reading-related processing in the brain. These studies confirmed that these measurements identify poor readers in languages other than English, a finding that lends weight to the theory of common underlying processes in reading. Because they look at neurological processing of information and not superficial behaviors related

to text, these approaches appear to be highly accurate in identifying learners with reading difficulties.

One of these studies measured event-related potentials (ERPs), the speed of the brain's response to hearing tones and order of sounds. Previous research had shown that poor readers of English react far more slowly to hearing tones than do normal readers, a finding corroborated by this study of young Chinese readers (Meng et al., 2005).

The second study is similar in that it measures speed, but here it is the speed at which the learners perceive that specific phonological information in a word, such as consonants, begins and ends. This approach is based on the theory that dyslexic readers generally have slower processing of information than do normal readers. As in the previous study, researchers demonstrated that measurements known to identify poor readers in English also identified them in Chinese (Penney et al., 2005).

Report of Findings — Part VI: Introduction to Literature Showing That Direct Testing for LD in Language Learners Is Not Possible or Is Problematic (Table 13, Parts A and B)

In the previous section, the possibility of direct testing of language learners for LD, RD, or FLLD was narrowly focused on skills related to language learning in both the learner's L1 and TL/FL. In this section, the literature showing that direct testing of ELLs is difficult or has risks has two general foci. One area of the literature focuses on rebutting the claims presented in the first section that skills in L1 or phonological or other skills provide a direct measurement of a learner's reading or learning. The second area focuses on demonstrating the myriad reasons that testing persons from other language and culture backgrounds, especially ELLs in the United States, carries many risks for these learners. The risks are seen in (a) the current process of evaluation of learners for learning problems, (b) the tools used to evaluate learners for academic purposes and as part of the evaluation process, and (c) the factors inherent in persons from other culture and language backgrounds that will necessarily cause the learner to obtain unintended results on tests.

Also included in this section is a report on a project to attempt direct testing of adult ELLs with the commonly used procedures for diagnosis of LD.

Report of Findings — Part VII: Evidence Countering the Premise That Phonological or Other Specific Skills Are Universal and Can Be Reliably Tested Across Languages

NL SKILLS AND FL LEARNING MAY NOT ALWAYS BE CLOSELY ASSOCIATED

The claim that FL learning problems have their roots in NL weaknesses has been strongly supported by research, though most of it has investigated this claim

in English-speaking students learning an FL. Research has been conducted to investigate whether this relationship was detectable in speakers of other languages learning an FL. Ferrari and Palladino (2007), testing Italian 13-year-olds, were unable to confirm that NL skills in poor English language learners were weak. These researchers suggested, much as Sparks concluded in his review in 2006, that perhaps foreign language learning difficulties are more learner- and even language-specific than they are general.

PHONOLOGICAL SKILLS ARE NOT THE SAME IN ALL LANGUAGES

Though studies cited earlier indicated that phonological skills were similar in both of a learner's languages and therefore testing could be conducted in either language to locate learning difficulties, other studies have not found that phonological skills are the same in all languages or play the same role in reading in all languages. Although the preliteracy phonological skills of children are generally agreed to be similar across languages, numerous studies show that once literacy is achieved, phonological skills become language specific. That is, phonological skills are not related to reading or writing proficiency the same way in every language.

Challenging the claim that phonological skills are universal, one group of researchers found that motor skills learned in the writing of Chinese, which is how reading of Chinese characters is learned, explained a greater part of the variance in skills of young learners than did phonological skills. The researchers concluded that while still playing an important role, the phonological skills in Chinese had a more complex, though secondary, relationship with the reading process compared to the relationship in English reading (Tan et al., 2005).

Durgonoglu and Öney (2002), in their study of adult Turkish women acquiring literacy, noted that phonemic awareness was much easier for adults to acquire in Turkish than in English, because Turkish is a highly transparent orthography. Similar differences in the phonological skills at the level of learners who have acquired literacy were observed in many studies of children of various language backgrounds, many learning other languages: Cho, McBride-Chang, & Park, 2007 (Korean); Duncan, Cole, Seymour, & Magnan, 2006 (English/French); Everatt, Smythe, Ocampo, & Gyarmathy, 2004 (English, Hungarian, Filipino); Goswami, Ziegler, & Richardson, 2005 (English and various L1s); Leong, Weng, & Tan, 2005 (Putonghua [Mandarin] & Cantonese); McBride-Chang et al., 2005 (English/Cantonese); McBride-Chang et al., 2005 (Cantonese, Mandarin, Korean, and English); Wade-Woolley & Geva, 2000, (English/various L1s); Seymour, Aro, & Erskine, 2003 (English and 13 other European languages); Swanson et al., 2006 (Spanish/English); Wimmer, Mayringer, & Landerl, 2000 (German). Several of these studies were large, with more than 500 subjects, and several were longitudinal studies.

PHONOLOGICAL SKILL WEAKNESSES EXIST IN THE NATIVE LANGUAGE, BUT NO FOREIGN LANGUAGE LEARNING DIFFICULTY IS OBSERVED

Two studies show that despite significant RD in L1, some learners are able to read in the TL or FL (in both cases, English) better than in their L1. This phenomenon was observed by van der Leij and Morfidi (2006), studying 14-year-old Dutch learners of English, and by Miller-Guron and Lundberg (2000), studying young adult Swedish learners of English identified as dyslexic in Swedish but successful in learning English, especially English reading. Again, Spark's caution that FLLD are very learner specific is called to mind.

PHONEMIC AWARENESS IN THE TARGET LANGUAGE WAS IMPACTED BY L1 PROFICIENCY

Cross-language transfer of phonological skills, particularly phonemic awareness, did not happen as

expected in 68 young Spanish English-speaking ELLs if the learner was not proficient in L1. Citing a number of studies with the opposite finding (that skills always transfer), these researchers noted that their study looked at the comparative transfer of skills in individual children with varying levels of proficiency in L1, different from the other studies where general statistical trends were considered (Atwill, Blanchard, Gorin, & Burstein, 2007). This finding correlated with the findings of Sparks et al. (2006) that NL oral proficiency impacted target language proficiency and illustrates the importance of evaluating NL proficiency in individual learners.

THE RELATIONSHIP BETWEEN PM AND LEARNING IS MORE VARIED THAN OTHER STUDIES INDICATE

In the first section, we saw several studies indicating that PM (as measured by NWR) was weak in learners with reading difficulties. This task is also widely used to identify language impairment among monolingual English speakers. However, in one study, though NWR scores were robust enough to identify young bilingual and monolingual learners with *no* language impairment, normal bilingual learners were not differentiated from language-impaired monolinguals by NWR (Kohnert, Windsor, & Yim, 2006). The failure to discriminate between these latter two groups occurred because the bilingual children were as proficient as or more proficient than the impaired monolingual children on the nonword repetition task (Kohnert et al., 2006), a finding seen in other studies. Fitzgerald cautioned that little of the research about bilingual or English language learners has taken into account the impact of *multilingualism* (2003). The fact that PM is stronger in bilinguals than monolinguals indicates that more investigation is needed to clarify the impact of bilingualism or multilingualism on many of the skills being tested in the studies.

Another challenge to the validity of NWR as a test for PM in certain learners comes from two studies on adults with limited or no literacy. Each study showed clearly that these adults scored poorly on the NWR task, while scoring similarly to literate adults in repetition of real words (Loureiro et al., 2004; Reis & Castro-Caldas, 1997). Whereas using PM as a test for literate ELLs could be supported from the literature, on the basis of these studies, testing nonliterate adult ELLs for PM using nonwords seems to be not indicated.

Other factors cited earlier as possible indicators of learning difficulties in language learners have been similarly found in other studies to be less reliable than expected.

RAN DOES NOT ALWAYS DIFFERENTIATE POOR READERS FROM GOOD READERS

Testing of 67 older school-age Dutch learners of English did not indicate a significant relationship between RAN scores and reading outcomes (Patel, Snowling, & de Jong, 2004), a finding similar to that of another study of Dutch older school-age ELLs (van der Leij & Morfidi, 2006). Patel et al. (2004) suggested that a different RAN (e.g., pictures, colors, or numbers instead of letters) might have evoked different results. They also suggested that the process measured by RAN may be subsumed by phoneme awareness, which is generally high in proficient readers of Dutch, and by generally developing phonological skills. This is similar to a question also raised by O'Brien et al. (2006)—whether RAN and proficient reading have a circular relationship, with high RAN scores being the result of reading proficiency, not the indicator of it. On the other end of the reading proficiency scale, nonliterate adults performed significantly more slowly than literate adults on RAN tasks involving pictures (two-dimensional information) than when naming three-dimensional, or real, objects (Mathuranath et al., 2003), again underscoring the effect of literacy on visual processing and in turn on tests typically used to identify reading disabilities.

MORPHOLOGICAL AWARENESS VARIES BY L1

A few studies in the first section indicated that MA appeared to be tied to reading proficiency in the TL or FL, even predictive of it. In other studies, however, the role of MA was found to have a different relationship to learners' reading levels in L2. Most relevant here is a study of college-age Chinese and Korean ELLs, where it was found that their MA in English was strongly influenced by their first language (Wang & Koda, 2005). In other words, the Koreans' MA in English was different from that of the Chinese and could be related to features of Korean Hangul, a finding also seen in young Koreans (Cho, McBride-Chang, & Park, 2007). Similarly, MA did not transfer from Hebrew to English in 57 older school children literate in Hebrew and learning English. The levels of MA were similar only when Hebrew MA was low, another finding challenging the universal transfer of language skills (Schiff & Calif, 2004).

That the relationship of PA and MA to reading varies in different languages was also observed in a large study of Korean, Chinese, and English learners. Generally, researchers observed that in Pinyin (a version of Chinese where words are represented in syllables and with phonemes) and English, phonological awareness was the more relevant skill to word reading, while in Korean and classic Chinese (i.e., reading characters as opposed to Pinyin), morphological awareness played a stronger role in children's reading skill (McBride-Chang et al., 2005), another indication that the processes of reading are not identical across languages.

These studies challenge the notion that most reading and language processes are analogous in all languages and can therefore be reliably tested across languages.

Report of Findings — Part VIII: Studies Challenging the Applicability, Reliability, and Validity of the Current/Traditional Model and Tools of Evaluation of ELLs for Learning Difficulties (Table 13, Part A)

ELLS ARE NOT FAIRLY EVALUATED IN THE CURRENTLY USED EVALUATION MODEL

Studies examining currently used procedures in K–12 for evaluating ELLs for learning problems provide evidence that this model does not ensure the fair and accurate evaluation of ELLs that was intended. The problems often do not arise with the model itself, but rather with the persons implementing it. This phenomenon was seen in several studies in which close examinations of documentation and records of cases of ELLs in K–12 referred for or placed in special education services were conducted. The research teams found many compelling inconsistencies and procedural gaps in the cases. Prominent in the studies was the failure of psychologists in the vast majority of cases examined to follow professional and legal guidelines for evaluation of nonnative speakers of English. Equally disturbing to the researchers was the tendency of testing personnel and others involved in various stages of the referral and diagnostic process to ignore cultural and language factors impacting the students' performance in classes and other mainstream settings (Figueroa & Newsome, 2006; Klingner &

Harry, 2006; Limbos & Geva, 2001; Poon-McBrayer & Garcia, 2000; Wilkinson, Ortiz, Robertson, & Kushner, 2006). Related to this were Klingner and Harry's observation in their qualitative study of the evaluation personnel's disdain and disregard for the parents of the learners and the prominence of cultural stereotypes in the evaluation process. In Escamilla's (2006) qualitative study, monolingual teachers with no training in bilingualism were observed judging the writing skills of students in a Spanish-English bilingual program, with the result that the teachers were judging normally developing language to be deficient and condemned learning Spanish literacy as having a negative influence on the learners' English skills. These studies indicate that evaluation of ELLs is susceptible to subjective judgments despite processes designed to prevent that.

Subjectivity in deciding if ELLs are at risk for LD is what Rueda and Windmueller (2006) and Ruiz (1995) contend is a major contributor to the overrepresentation of ELLS in special education. In other words, they contend that LD is a socially constructed idea and learners are considered impaired or not impaired according to the context in which they were asked to perform and in which the testing was done, and according to which tasks and tools were used (Ruiz, 1995), a situation seen repeatedly in studies cited earlier on problems with referrals of ELLs for evaluation for learning problems. This point of view is highly relevant to the adult ELL arena, where learners may be suspected of having LD for a wide variety of reasons voiced by a broad mix of variously trained personnel using an endless array of methods of evaluation.

IN-TEST FACTORS IMPACTING THE OUTCOME OF ELLS AND THEREFORE CHALLENGING THE VALIDITY AND RELIABILITY OF STANDARDIZED TESTS

Just as the evaluation process for learning difficulties as a whole has problems for ELLs, tools used in the evaluation have also been found to be problematic for this population because of intrinsic features in the tests and tools. Because these features can theoretically be adjusted in testing tools, these problems are considered separately from issues that are inherent in learners.

Language Issues

Language issues are prominent in the literature investigating the currently used models of evaluation of ELLs' learning progress and learning challenges.

Complexity of language on tests. The recognition in the field of testing that the language used in tests poses unwanted challenges for nonnative speakers of English is hardly recent. Brigham, who is considered the father of the Scholastic Aptitude Test (SAT), worried about language issues in testing more than 70 years ago:

> For purposes of comparing individuals or groups, it is apparent that tests in the vernacular [English] must be used only with individuals having had equal opportunity to acquire the vernacular of the test. This requirement precludes the use of such tests in making comparative studies of individuals brought up in homes in which the vernacular of the test is not used, or in which two vernaculars are used. The last condition is frequently violated here in studies of children born in this country whose parents speak another tongue. It is important, as the effects of bilingualism are not entirely known (Brigham, 1930, p. 165, in Figueroa & Newsome, 2006, p. 1).

Language issues are still of concern in examining how ELLs are evaluated in current literature:

> ELLs generally perform lower than non-ELLS on content-based assessments...a

> strong indication that English language proficiency affects instruction and assessment. Research also shows that ELL students' assessment outcomes suffer from lower reliability and validity; that is, language factors may be a source of measurement error in the content-based assessment of ELL students and may impact the reliability of the test. Language factors may also be a source not relevant to the construct of such assessments…and may affect the test's construct validity (Abedi, 2006, p. 2284).

Abedi (2006) argued that because a variety of linguistic factors in language on tests challenge validity and reliability, ELLs may be penalized and more often seen as LD or RD than they actually are. This happens because "unnecessary linguistic complexity makes assessment more difficult for ELL students, thereby reducing their performance level. Lower performance level then creates a restriction of range for the ELL performance distribution, and that in turn results in lower reliability [of testing tools] for ELL students" (p. 2291). In fact, Abedi et al. supported this claim in two ways. First, when ELLs and English speakers were tested on the same achievement tests, ELLs obtained lower scores on the language-heavy sections but not on the math portions, which had relatively little language. Also, when test language was simplified, ELLs obtained scores more similar to those of non-ELLs, illustrating how test language affects test validity for ELLs (Abedi, Leon, & Mirocha, 2003).

Closely related to language complexity is the issue of BICS and CALP (oral proficiency vs. academic language proficiency—see Part II, Theories Referred to in the Review or Underlying Research, for a discussion of this theory). CALP includes being able to deal with grammatical, syntactical, and language complexity as well as with deeper (i.e., conceptually more complex or synonymous words and expressions) vocabulary. CALP can be seen as an in-test problem when the language of the test will normally exceed the CALP of the learners taking it. Brown (2005) observed the effect of this gap when ELLs who were rated fully English proficient (i.e., their oral proficiency exceeded levels required for ELL classification) and who had the highest English *oral* proficiency and highest home-language literacy of all ELLs taking an achievement test in English, in fact obtained the lowest scores relative to those of English speakers. Brown proposed that the level of academic language on tests continues to rise through the grades, and consistent with theories of BICS and CALP, the ELLs' oral proficiency was strong enough to exit ESL classes, but their CALP (academic English) did not keep pace with the language needed for testing in English. As a result, the ELLs scored lower on the achievement tests than English-speaking peers in the same grades (Brown, 2005). This effect was also observed in two studies of young language learners who had had similar amounts of schooling as peers who were native speakers of the language, but whose overall reading fell below that of the peers. Though phonological skills were fully developed, reading vocabulary was not, and, consequently, reading comprehension was diminished for the language learners (Droop & Verhoeven, 2003; Hutchinson et al., 2004).

Word frequency. The effect of word frequency—how often a word is encountered in reading—was observed in several studies and is a factor Goswami (2002) felt should be considered more carefully in designing tests for ELL readers.

Relevant to the issue of testing adult ELLs, and contrary to researchers' expectations, word frequency was a more significant factor in accuracy and speed of reading English than regularity of English spelling for adult ELL speakers of Chinese, Korean, Japanese, and Persian (Akamatsu, 2002; Wang & Koda, 2005).

Training Dutch learners of English on a body of words from their English texts to create a false frequency for those words increased fluency (i.e.,

speed), as seen in the Akamatsu and Wang and Koda studies cited above, but not overall reading comprehension (Fukkink, Hulstijn, & Simis, 2005). The researchers noted that reading speed was apparently only one part of reading proficiency, and they suggested that readers from other orthographies, who may read in L2 more slowly, may have compensatory strategies for accurate reading. In fact, subjects in Wang and Koda's study reported that they preferred to sacrifice speed for meaning access, (2005), as learners appeared to have done in the Dutch study. Thus, on testing that is timed, or where quantity of text read is an issue, ELLs may be at a distinct disadvantage compared to more experienced readers, especially those reading in their NL.

Language proficiency. In the evaluation process, ELLs' language proficiency (LP) is normally assessed both to determine if problems exist in the first language and in which language testing can confidently be done. In the studies of the evaluation process reviewed above, learners' language skills were frequently not assessed or were assessed inappropriately, contributing to what the researchers felt was misdiagnosis and inappropriate placement in special education (Figueroa & Newsome, 2006; Klingner & Harry, 2006; Limbos & Geva, 2001; Poon-McBrayer & Garcia, 2000; Ruiz, 1995; Wilkinson et al., 2006).

MacSwan and Rolstad (2006) concluded that the high rate (as high as 90%) of Spanish-speaking young ELLs classified as nonproficient in L1 in evaluation procedures was the result of the faulty design of tools used to evaluate LP. MacSwan and Rolstad evaluated the L1 of young ELLs previously evaluated with two commercially available tools. Their evaluations using natural language samples resulted in LP ratings *exactly opposite* of those obtained on the two widely used commercial LP evaluation tools. As a result, the researchers proposed that these tools lacked theoretical validity. LP testing of this type must be abandoned, they maintained, because of the prejudicial results (2006).

Cultural Load on Tests Impacts Learner Outcomes

Though cultural issues have long been suspected of playing a role in poor ELL testing outcomes, they are difficult to isolate and identify, and little hard evidence is available of this effect. Three studies give an idea of the problem. In a numerical analysis of items on the Comprehensive Test of Basic Skills (CTBS) administered to 1,259 second- to sixth-grade students in English and in a Spanish language version purported to be linguistically and culturally equivalent, numerous items were found to have cultural bias for one language or the other. That is, cultural factors would influence how students would interpret and answer items on the test. The number of items with cultural bias was sufficient to have a statistically significant impact on scores (Cabello, 1984). Though derived from only one study, this evidence demonstrates the possibility that culture is a factor in testing that contributes to construct validity and reliability issues just the way language complexity does.

Culture differences in content and language, not reading skills, were seen as the cause for Malaysian students becoming bilingual in English to perform far below norms on the Wechsler Objective Reading Dimension (WORD), a reading test developed for and normed on native speakers of English (Gomez & Reason, 2002).

The third study concerned college students of "non-European background," who, in a reflection of the K–12 trend, were far more likely to be referred for LD testing than their peers of "European" background and, when tested, were more often diagnosed with LD than students of "European" background. The researchers confirmed that by changing cutoff scores for LD designation just slightly downward, a far smaller percentage of "non-European" students would be classified as LD—one approaching the percentage of "European" students (Warner, Dede, Garvan, & Conway, 2002). Researchers propose that there are subtle factors that can cause standardized

tests to be inappropriate, if not invalid, for learners not of mainstream "European" U.S. culture.

IN-LEARNER FACTORS THAT INFLUENCE LEARNER OUTCOMES ON TESTING, RENDERING TESTING UNRELIABLE OR INVALID (TABLE 13, PART B)

Factors inherent in ELLs impact not only testing outcomes but also, more important, affect how these learners are seen by their teachers or others in the learning situation. Evidence of these factors is ample. Three major topics are of greatest interest here: issues related to language, learners' prior education, and learners' backgrounds.

Language Issues

Looking at the issue of testing adult ELLs for learning challenges from the point of view of problems in the evaluation process and testing tools, we saw that language played arguably the most prominent role in inappropriate or incorrect diagnosis and poor outcomes on testing. These extra-learners issues can theoretically be adjusted on tests, evaluation procedures, and instructional materials to diminish the impact of the problems, as Abedi, Leon, and Mirocha (2003) demonstrated. However, intra-learners language issues are perhaps even more of a factor in considering testing instruments and fair testing since they cannot be controlled for. Here, we consider issues that either contribute to the learner's appearing to have learning problems, prompting the idea that he or she should be tested, or that will further handicap individuals taking tests in English.

Age and language learning. Most prominent of these intra-learners factors is that of age in language acquisition. Adults learn language quite differently from the way children do, both behaviorally and neurologically. If their language learning is evaluated by standards derived from learning rates and patterns of younger learners or with assessments developed to measure language acquisition of younger learners, older learners will necessarily seem to be poor language learners or to have learning problems. Neurologically, adults learn language differently than children—in part because adult brains do not process new language sounds as efficiently as children's brains do. As a result, hearing all the sounds in a new language accurately is more difficult for adults (Kuhl, 2004), and confusion in construing meaning can ensue (Pallier, Colome, & Sebastien-Galles, 2001).

In addition to not hearing sounds accurately, the brain will not be able to translate new, unfamiliar sounds into speech gestures in a way that resembles speech of native speakers (Kuhl, 2004), a problem observed in a study of Japanese adult ELLs. In these learners, poor articulatory awareness (i.e., the ability to demonstrate how sounds in a language should be pronounced through placement of tongue, lips, etc.) correlated positively with poor reading in English (Yamada, 2004). Yamada speculated that articulatory awareness is associated with poor articulation and, in turn, with poor development of phonological awareness in a new language, leading to reading difficulties in English for ELLs. Yamada contended that articulatory awareness has little to do with education, citing studies in which, despite lacking phonemic awareness, illiterates had articulatory awareness in their first language (Adrian, Allegria, & Morais, 1995). As neuroscience teaches, mechanisms of auditory perception in the adult brain would result in Yamada's learners' having difficulty deciding how to pronounce words in a *new* language, while illiterate subjects performed as expected in their L1.

One of the most commonly observed effects of aging on language acquisition is that the impact of the phenomenon of a common underlying proficiency disappears, or at least lessens significantly (see discussion in methodology section, p 129). Acquisition of grammar is no longer unconscious and apparently effortless, as it is in children, but rather is conscious and effortful. Older learners may never develop grammatical sensitivity (i.e., the ability to know if a sentence

is correct or not), a phenomenon seen in immigrants who arrived in the United States at different ages (Dekeyser, 2000; Yeni-Komshian, Robbins, & Flege, 2001), with those arriving as young teens developing a far better grammatical sensitivity than those who arrived as adults (all without formal education in English). Acquisition of grammar in a new language is proposed to be effortful for adults because of the shifting burden of attention that is required to make grammatical judgments, a process that young language learners are presumed not to experience (Taube-Schiff & Segalowitz, 2005). This finding was amplified by McDonald (2006), who explicitly investigated the types of interference, such as noise, having many things to remember, or having severely limited time to perform a task, that ultimately reduced older adult learners' grammatical judgment in the study. Another effect of age seen in a comparative study was slower processing of feeling-laden words. These words apparently carry meaning not always directly translatable. Consequently, adult brains do not process them as automatically as less feeling laden words (Segalowitz, Trofimovich, Gatbonton, & Sokolovskaya, 2008).

Because it is a conscious process with neurological challenges, language acquisition in adults is more dependent on external factors than it is in children. The frequency effect, previously seen in studies of reading fluency and comprehension, was seen as an external factor significant in adults' learning of oral language and phonological features of language. In other words, adult language acquisition is affected by how much adult learners are exposed to sounds of the new language, how frequently certain words and sounds in words occur in the speech of those they listen to, and how much they are exposed to native speakers of the language they are learning (O'Brien et al., 2006; Trofimovich, Gatbonton, &, Segalowitz, 2007).

This evidence indicates that an adult's language learning could appear to be impaired for a wide variety of reasons related to age of learning, and specific, static testing would likely not give an adequate picture of learning for an adult learner.

Learners' Education, Prior Knowledge, and Ability to Demonstrate Knowledge

A learner's education level impacts virtually every aspect of learning in a new language: At the beginning stage, phonemic awareness increases with one's level of literacy (Adrian, Allegria, & Morais, 1995; Durgonoglu, 2002; Loureiro et al., 2004; Royer, Abadzi, & Kinda, 2004). Phonological awareness, including phonemic awareness, was one of two factors that best differentiated both adult and child illiterates from literate age-matched subjects in Brazil (Dellatolas et al., 2003). As previously noted, phonological memory (PM) was significantly poorer in nonliterate learners than in educated learners (Loureiro et al., 2004; Reis & Castro-Caldas, 1997). Reading proficiency, ability to acquire literacy skills in English, and phonological skills of adult Spanish-speaking ELLs were highly correlated with level of education in Spanish (Ijalba, 2008). At the higher end of the education scale, TL reading skills of adult Serbo-Croatian learners of French were significantly related to the degree to which the learners maintained reading skills in their L1, Serbo-Croatian (Pichette, Segalowitz, & Connors, 2003), confirming the cross-language transfer of higher levels of language and skills needed to attain and sustain them.

Impact on testing outcomes. The influence of prior education and exposure to or knowledge of specific subjects on second-language testing or on showing knowledge is complex:

> A reader's prior knowledge on a topic influences his or her ability to read a text on that topic with comprehension and affects the amount of information that can be retained from reading such a text. The research on the effects of L2 knowledge on reading

> comprehension indicates the importance of sensitivity to the prior-knowledge demands of texts. Failure to consider these effects in the development of L2 reading tests may lead to erroneous conclusions regarding learners' competence in L2 reading since examinees may perform poorly because they lack either the background knowledge or cultural knowledge that is assumed by the text rather than because they are unable to read in the second language (Carlo & Skilton-Sylvester, 1996, p. 45).

The effect of information retention being impacted by limited prior knowledge of a topic was seen in 94 adult college students tested in their FL (Spanish). These FL learners were less able to remember information in Spanish about topics with which they had little or no familiarity than about topics with which they were fully familiar (Leeser, 2007). Lack of familiarity with a topic affected the working memory of other adult learners of Spanish ,according to another study. The learners had difficulty remembering key information and retaining new vocabulary or grammar structures despite being able to comprehend the passages well when topics they were reading about were unfamiliar (Pulido, 2007).This finding and Carlo and Skilton-Sylvester's observations (1996) are especially relevant to the evaluation of adult ELLs, where topics on tests or in books may be totally new to learners with limited education, or whose education did not encompass topics frequently found in ESL texts.

Language of testing handicaps demonstration of prior knowledge. When tested in content learning, ELLs may be found deficient. In fact, they may have prior knowledge of a topic but be unable to demonstrate that knowledge. In a study exploring whether NL or TL was the more reliable route to testing content knowledge, researchers found that when science and math items were administered to students in English (their TL) and in their NL (Haitian Creole, Chinese, or Spanish), "the quality of the students' responses was inconsistent across both items and languages" (Solano-Flores, Lara, Sexton, & Navarette, 2001, p. 2357). The authors concluded that it would be impossible to determine which language students should be tested in on the basis of means taken from these scores, since the scores cancel each other out.

The demonstration by Solano-Flores et al. (2001), which showed that learners might do better in one language on some items and in the other language on other items, was echoed in a study in which Spanish-speaking fourth- and 10th-grade students took the Stanford Achievement Test, ninth edition, and the Aprenda, second edition, a Spanish achievement test. The students scored better on the same content material on the Spanish language instrument than on the English instrument (Abella, Urrutia, & Shneyderman, 2005). In a further analysis, researchers concluded that the fourth-grade students' scores in Spanish were not related to home language literacy, while the 10th-grade students' scores were. One hypothesis proposed that older ELL learners had more education in the first language but not the English proficiency (CALP) to demonstrate it—as Brown (2005) also proposed.

Language of testing could be seen as an in-test factor, because the language of testing could theoretically be changed, except for the findings of Solano-Flores et al. (2001) that demonstration of knowledge in a given language was inconsistent, in which case even changing the complexity of language might not permit ELLs to demonstrate knowledge in the TL.

Orthography of prior literacy Another factor of reading subject to the influence of prior education is the orthography, or actual type of script, in which a literate learner has become literate . Much of reading efficiency appears to be directly related to the orthography in which a learner has learned to read. As Bernhardt cautioned, because so much reading research has arisen in English-speaking countries, the reading research often *assumes* that the processes of

reading are the same in other languages as they are in English (2003). In fact, this is the basis of the Central Processing Hypothesis (see Part I, Key Concepts and Definitions of Language Processing and Reading). However, researchers are increasingly studying in what ways the reading process is different in different languages. Koda concludes that virtually all reading processes in L2 are first accessed in readers' L1 (if they are literate) (Koda, 2004), as demonstrated in several studies below.

Visual access to meaning differs by orthography. Koda has demonstrated that different orthographies cause readers to depend on visual information differently when reading and understanding words. Some orthographies permit the reader to obtain meaning from the visual information (e.g., homonyms *see* and *sea* in English), while others require phonological coding in addition to visual information for words to be meaningful (e.g., words written without vowels in Arabic must be read according to context) (Koda, 1988). In a study highly relevant to the question of measurement of disability in different languages, the ease of visual access and shallowness of the orthography in Spanish facilitated the performance IQ outcomes of young readers and speakers of Spanish on IQ testing relative to peers reading English on IQ testing (Jimenez, Siegel, & Rodrigo Lopez, 2003). In other words, the Spanish children had higher performance IQs in reading in Spanish because they could read the test items better on the Spanish IQ test than their English-speaking peers could read similar items on the English IQ test. This outcome, combined with the findings of researchers noted earlier on the impact of language complexity on ELLs' outcomes on testing would seem to seriously undermine the effectiveness and validity of many tools used for traditional evaluation of learners for LD.

Processing is language specific. Two other studies underlining Koda's hypothesis that all reading tasks are processed as they were learned in L1 showed that even when a reading task is structured the same way or identical words are used, readers process text according to the phonological structure of their own L1 (Miller-Guron & Lundberg, 2004; Ziegler, Perry, Jacobs, & Braun, 2001).

OP does not transfer. While most other language processes are assumed to transfer relatively directly to a new language, OP (efficient reading of letters and words) transfer decreases as the script varies from the one in which the learner first learned to read (Bialystok et al., 2005; Geva, Wade-Woolley, & Shany, 1997; Schiff & Calif, 2004). When orthographic systems are very different, such as Korean and English, the first may actually obstruct acquisition of orthographic processing in the TL/FL (Wang et al., 2006). That is, the learner must learn new visual and motor patterns for reading and will necessarily read much more slowly in a new script or writing system than in that of the L1

For a learner already literate in L1, reading is an interactive process. Korean adult ELLs were more able to read regular nonwords than Chinese adult ELLs, which researchers posited was an effect of the highly regular nature of Hangul (Korean script) (Wang & Koda, 2005). These researchers propose that for learners literate in another language, the reading process may be an interactive one, and, therefore, both languages of the learner must be taken into consideration when examining how a literate language learner is reading in a new language. In fact, for college ELLs, reading and writing processes were observed to be highly interactive, and processes transferred differently according to the learner's first language (Carson, Carell, Silberstein, Kroll, & Kuehn, 1990), a finding predicted by Koda(1989) and confirmed in her later studies (2004).

Acquisition of orthographic competence varies by orthography. One relatively obvious difference in the effect of orthographies that has been documented on a large scale is that learners become proficient readers and spellers in regular, more transparent orthographies much faster than they do in more opaque ones.

In fact, the challenges that English presents to readers cause new readers and writers to acquire fluency up to *two times* more slowly than readers learning to read in other orthographies (Gholamain & Geva, 1999; Seymour et al., 2003). Because of this factor, adult learners from different literacy backgrounds will necessarily acquire reading and writing at very different rates, and the rate of acquisition of orthographic competence in English for nonliterate adults is likely to be very slow.

Again, reading behaviors that may be interpreted as symptomatic of reading problems could well be the result of learners' differing educational backgrounds.

Visual processing of abstract drawings is subject to level of education. In the study of Dellatolas et al. (2003), the other factor besides phonological awareness differentiating the literate from nonliterate learners in the study was the ability to interpret abstract drawings. Greenfield (1997) vividly illustrates the effect of nonliteracy on visual interpretation of drawings and figures in her qualitative investigation into whether these items are usable in psychological testing with uneducated subjects. Visual processing challenges extend to the understanding of the concept of a story in pictures. Adult learners in a literacy program who had no prior literacy had to be explicitly taught how to follow a picture story (Comings & Soricone, 2005). Pictures are used extensively in instruction and testing of the low-literate or nonliterate adult ELLs, but this information indicates that not all learners interpret pictures in the way intended and some could obtain lower-than-expected outcomes on certain types of testing in which pictures are used.

Background Issues—Socioeconomic Status, Culture

Another factor found to depress scores on various types of testing is the socioeconomic status (SES) of learners. SES had a positive correlation with lower outcomes on a variety of testing in several studies (Brown, 2005; Droop & Verhoeven, 2003; Kahn-Horwitz, Shimron, & Sparks, 2006), and was presumed to be the cause of lower scores for some learners in others (Cisero & Royer, 1995; Ijalba, 2008). Some researchers propose that this effect occurs because low SES may be associated with limited opportunity for schooling, and, thus, limited education impacts many aspects of testing (Ijalba, 2008). Here is yet another factor present in the adult ESOL population that possibly affects prior learning and testing outcomes in many ways.

Culture was discussed earlier as a factor impacting ELL outcomes on tests. It is also possible that a learner's cultural conditioning will impact how she or he approaches certain typical tasks in testing. This effect was observed in young Arabic, Chinese, and English learners, some of whom were dyslexic. The study showed that visual-spatial tasks typical of nonverbal intelligence testing were performed differently according to the learner's cultural conditioning for such tasks (Everatt, Jeffries, Elbeheri, Smythe, & Veii, 2006). Dellatolas et al. (2003) also proposed that how learners interpret drawings and other two-dimensional information depended not just on the level of education, but on how their culture uses these forms and trains children to interpret them. These results challenge the use of so-called nonverbal testing across cultures.

Testing Adult ELLs Poses a Wide Variety of Challenges

Many of the issues discussed above were illustrated in a trial project to determine whether LD could be identified in adult ESOL learners using the traditional testing model. In this project, fully certified psychologists and educational specialists familiar with adult learners from other cultures and experienced in testing adults attempted to give a full testing battery to 25 adult ELLs. One learner out of the 25, a college student, was successfully tested and diagnosed with LD. The 25 students tested were mostly African, ranging from 29 to 52 years of age. All had been referred for testing because of "significant lack of progress," and all

but one had repeated beginning ESOL classes in their programs multiple times. Time in the United States varied from 1 to 20 years and education from almost none to completion of some college, with most having had just a few years of formal education. Several reported experiencing severe trauma (witnessing or being the victim of extreme violence), having head injuries, chronic illness, and other problems (LDA of Minnesota, 2006). This project and its results raise a number of questions concerning evaluation of adult ELLs for LD:

- **Is it helpful to diagnose these learners?** In the case of the college student, who was able to request specific accommodations at his school as a result of being diagnosed with LD, the testing was reported to be enlightening and helpful. For many of the other 24, however, the examiners reported that the experience was negative, and the intended advantage to the learners was not explicit to them. Little light was shed on the cause of their struggles in learning.
- **Is such testing accurate in identifying LD?** The examiners noted that given the low education and low English proficiency of most of these learners, the results were inconclusive. Several subjects were unable to complete the testing because of cultural and educational barriers. In contrast, the college student was already familiar with American testing procedures. Thus, accuracy or validity appeared to depend on the ability of learners to take tests and their familiarity with the type of testing used.
- **Do culture and language impact testing outcomes?** The interference of culture, language, and level of education was reported to be different and greater than the examiners expected. Some learners were confused by the nature of testing tasks and some by the whole prospect of being tested. The concerns of Solano-Flores (2006) and of Murphy (2007) about the challenges to the construct validity of the tests that language and culture pose seem vivid here.
- **Were these students truly at risk for LD?** First, the report indicated that many of the learners in the project had mental and physical health problems that no doubt interfered with learning, but whose effects were not evaluated. Second, most had very low levels of education and unless their educational needs were adequately addressed, these could have contributed to their learning problems in ESOL programs. Testing not only did not reveal that issue, but was affected by it.
- **Was testing carried out with all due professionalism?** Though the project and testing were undertaken by fully qualified professional diagnosticians who took many unusual precautions in ensuring that testing would be accurate and as comfortable as possible for the adults, the examiners confessed that they overlooked the fact that the subjects did not match the norming populations at all. Similarly, guidelines for determining the CALP of learners before undertaking testing were ignored. Just as was documented by Figueroa & Newsome (2006), Wilkinson et al. (2006), and the other researchers looking at the traditional testing model, these examiners failed to follow the guidelines of the testing tools and their profession sufficiently to prevent negative outcomes for learners.

On a positive note, echoing studies reviewed earlier, this report indicates that referrals for testing were fewer than expected because adult ESOL teachers had been provided with training and information about factors that impact their learners. This points to the findings of Ijalba (2008) and Harrison & Krol (2007) that, with guidelines, teachers could be more accurate in deciding which learners appear to be truly at risk for LD/RD.

Though this is a nonempirical study and was not published in a peer-reviewed journal, this report bears heavily on the topic at hand. It serves to illustrate a number of the factors discussed in the research above, and provides examples of further issues that must be considered in thinking about direct testing for LD in adult ELLs.

Discussion, Conclusions, and Recommendations

OVERVIEW

The overall effect of the research is that the two sides of the issue of direct testing of adult ELLs for LD or RD balance each other, with the result that the only clear picture that emerges is that the issue is still undecided. The issue of testing through reading of text in English is shown to be fraught with problems that cannot be solved. Several approaches to direct testing of specific phonological skills or other factors appear to show promise, but that promise is challenged by newer studies providing enough evidence to show a trend in research that will continue to question the possibility of universal testing through oral or visual tasks related to language processing. The tiny body of evidence showing that evaluation of brain processes may prove a more reliable route to identification of true reading disabilities in any language is encouraging, but it lacks weight as yet. It should be carefully noted, however, that the lack of consistency in the type of learning difficulty that researchers say is being studied, in methods of investigation as well as in virtually every aspect of the issue, renders conclusions tenuous in the extreme.

OBSERVATIONS ABOUT THE TWO SIDES OF THE EVIDENCE IN THE REVIEW

Premise One

The first premise of the research supporting testing is that second/foreign language learning difficulties have their roots in first-language weaknesses. The majority of this evidence comes from testing foreign language learners in English, their first language. While the findings are robust, have been replicated one way or another by others, and have been shown to have longitudinal implications, they are nonetheless almost entirely in English. The research attempting to replicate these findings in learners who speak other first languages and are learning English has very mixed findings. Some, such as Ijalba (2008), claim to have confirmed first-language weaknesses by testing in ELLs' first language (though the findings are attenuated by the fact that many identified with phonological weaknesses had limited formal education), an alphabetic language (Spanish), while others have attempted this in Chinese (Harrison & Krol, 2007), a nonalphabetic language. One well-designed study showed, however, that the relationship of the phonological skills identified by Harrison and Krol in the Chinese speakers in their study to reading in Chinese are not analogous to skills in English (Tan et al., 2005), undermining the claim that testing in English is valid for speakers of Chinese. Others have found that once literate, learners in different languages have widely varying phonological skills, further challenging the premise that core phonological skills are the same in every language. At least one study directly challenged the premise of weak native-language skills correlating with foreign language learning difficulties (Ferrari & Palladino, 2007), while another found that learners classified as dyslexic in their NL had no corresponding reading difficulty in English, their TL (Miller-Guron & Lundberg, 2004).

Premise Two

If we accept that NL phonological skill weaknesses underlie FL/TL learning weakness, then the second premise of the research is that RD or other learning difficulties in language learners may possibly be identified through testing that focuses on a variety of these skills.

Phonological skills confirming strength or weakness in reading. Deriving from the notion that language-learning problems are rooted in weaknesses in core language processes such as phonological awareness, this premise has also been supported through a number of studies on a variety of factors. However, just as the premise of the connection of first-language weaknesses to target language-learning weaknesses has been challenged, the premise of specific core skills being universal has also been severely questioned. For example, while a skill such as phonemic awareness has been shown to correlate with reading skill in a number of studies, others have shown that phonemic awareness plays a different role in different languages and, therefore, is not equivalent across languages.

The second part of this issue is the language of testing. Where it was possible to test phonological skill weakness in both the learner's languages (the learner's dominant language and the TL), the premise of cross-language validity of these skills appears to be confirmed (e.g., Harrison & Krol, 2007). Where testing was done in the target language, the testing confirmed that learners known to have learning problems had difficulty with core phonological skills in the target language (e.g., Gomez & Reason, 2002). These findings are again weakened, however, by the fact that a number of studies have challenged the cross-linguistic nature of specific phonological processing skills (e.g., Tan et al., 2005).

Phonological and other specific factors that could predict learning problems. Here the evidence for the predictive nature of PM and orthographic processing seems relatively robust. However, other studies have weakened that stance. PM, which seemed to hold real promise for identification of impaired language learners, has been shown, among other factors, to be dependent on education level, literacy skill, and oral proficiency in more than one language. This makes that task of questionable value for identifying adult ELLs with learning problems, since many of that population may have low or nonexistent prior literacy and many are multilingual. Similarly, OP seemed to be a strong predictor of reading problems, but evidence of the highly language-specific nature of this skill and the low transferability of it significantly undermines its usefulness in this realm.

Other factors have shown interesting possibilities for identification of learners with impairments of some kind: RAN, which has been shown to have high correlations with reading skill in many languages, has not always stood up to scrutiny and appears to be somewhat susceptible to fluency in some aspects of reading. Also, RAN (with pictures, drawings, letters or numbers) would be of questionable value for someone with virtually no formal schooling experience because of visual-perceptual and processing issues. Working memory has emerged in a few studies as having predictive strength, but in studies on adults, it has been shown at least once to be highly susceptible to the degree of exposure the adult learner has had to a given topic. The strength of receptive vocabulary and oral skills as predictors of learning issues would seem a very useful measure in light of the first premise—that first-language skills will influence second-language learning. However, the connection between low vocabulary, less developed L1 oral skills, and real learning problems in L2 seems tenuous in the face of issues of register, dialect, education, and speech community of adult learners. That is, the adult learner's L1 skills could more likely reflect his or her education and daily usage than they do actual learning challenges.

Speech perception may be very useful as an identifier of reading problems, but currently there is very little verification of its identifying strength in a wide

variety of populations. The issue of MA as a skill that might correlate with learning challenges in the TL has been as strongly questioned through studies as it has been supported.

All three alternative approaches to identification of reading and or language learning difficulties appear to hold promise but have very little research base at present. Dwairy's tool (the DLD) presents a less language-bound model of language aptitude tests, an approach to language-learning screening that has stood the test of time and studies in the MLAT.

The two studies on brain processes also present ways of identifying reading-impaired learners that appear to bypass tasks that are language dependent, but as of now, this approach is unrealistic for most arenas of ESOL.

Of all the alternative approaches that appear in the literature, the possibility that teacher evaluation of learners can be relatively accurate when teachers are provided with criteria with which to evaluate learners' performance is the most appealing for adult ESOL. Though the evidence is still relatively thin, the results of studies were good, and the dampening effect of helpful information on the tendency of teachers to refer learners for any reason is illustrated in the LDA report.

Premise Three

The third premise emerging from the literature is that direct testing is not possible because traditional testing methods do not work.

Paradigm issues. The evidence reviewed here indicates that, despite carefully designed prereferral processes, legal and professional guidelines, and resources intended to ensure the fairest evaluation possible for ELLs, referrals and placement are very often inaccurate. This conclusion lends considerable weight to the objections raised about this evaluation paradigm over several decades, and, important to this review, the LDA report on testing adult ELLs indicates that even in an adult setting, similar problems exist. Certainly, the lesson here is vivid: All possible precautions must be taken to ensure that all information about learners in question is gathered, examined, and taken into account as the evaluation process proceeds, including other appropriate procedures and policies to ensure double-checking that procedures have been followed.

In-test issues. The premise is supported by studies of the tools of the evaluation process. Evidence as to the challenges that culture and especially language pose for ELLs on tests where reading in English is necessary is compelling and growing. Likewise, the evidence that even testing in the first language does not guarantee fair testing of content knowledge for ELLs warns against assuming that a reliable measure of a learner's learning and skills is possible. This is a particularly important warning for adult ESOL, where the tendency to suspect learners of having learning disabilities is often based on results of a variety of tests given in English. Though some proof is offered that when language is simplified, ELLs in K–12 settings can perform at levels similar to those of native English speakers, it is hard to imagine that tests used in adult ESOL could be adjusted to match the myriad education and culture backgrounds of learners there. The significant challenge to the assessment of first-language proficiency reported by MacSwan and Rolstad (2006) is another reason that the current paradigm of evaluation is problematic for ELLs.

In-learner factors impacting testing outcomes and influencing evaluation of learners. The in-learner issues presenting construct-validity challenges to tests are numerous, and the evidence is also sufficient to at least inspire great caution in interpreting how any given learner performs on a test. The most compelling issues for adult ELLs are those relating to age of language acquisition and prior education. The effects of these two factors are almost impossible to calculate since they impact virtually every aspect of learning and, therefore, are elements that must be considered in attempts to test such things as phonemic awareness,

phonological memory, orthographic processing, receptive language, and working memory.

The larger lessons here are that the in-learner factors cannot be adequately controlled for in testing, and that the combinations of these factors in any given learner make the evaluation process incredibly complex.

CONCLUSIONS AND RECOMMENDATIONS

1) We are in the process of discovering more about how adults from different culture and language backgrounds process sound, text, and information and learn languages. The more we learn, the more we see that there is not yet a viable language-based, universal way of evaluating learning or language learning. Furthermore, what we really want to know is *why* the learner is not learning, not simply *that* he or she is not making progress. For adult learners, this fact dictates a much broader look at their learning than direct testing for learning problems would permit.

2) It is necessary to find ways to evaluate learners who struggle that preclude culture and text insofar as possible. These might include—
   a. Teacher evaluation of learners based on a set of criteria that offer teachers ways of taking into account some of the more obvious factors that could cause learning challenges. This was the method described in Ijalba's 2008 study, used by Harrison and Krol, and referred to in the 2006 LDA report. In all three instances, teachers were provided with information about adult ELLs and possible effects of culture, lack of education, and other factors that could impact learning. Teachers were also provided with the basics of second-language acquisition, a topic that a number of teachers of adult ESOL know little about since little credentialing is required of them. With this information, teachers were more able to make informed decisions about learners who were struggling to learn.
   b. Establishing learning or growth curves for different populations against which a given learner's performance can be evaluated. Since direct testing appears not to be possible, and is already seen as an unreliable way for LD or RD to be identified even in native speakers of English, the Shaywitzes and colleagues have recommended the use of growth curves in which a learner's progress over time is compared to that of other learners (see, for example, Shaywitz, Fletcher, & Shaywitz, 2006).

3) Given the evidence of the impact of prior education and of age of language acquisition, more complete evaluation of learners is necessary early in the instructional process. This could be addressed by—
   a. Establishing policies that require more complete evaluation of learners at intake. This would permit that information such as first-language proficiency, basic phonological skills, visual and motor skills, auditory processing, and especially level of literacy and world knowledge be obtained *before* instruction begins. Using this information, programs can more accurately place learners and more realistically design instruction so that learners do not struggle needlessly.
   b. Ensuring that all key factors impacting learning (e.g. education level, health, mental health, cultural attitudes) are reevaluated if a learner begins to struggle.

4) To ensure that learners' issues are understood and information gained from evaluations is used effectively, program personnel need a high level of awareness of the issues. This means—
   a. Professional development for teachers and program personnel working with adult ELLs should include at least, basic training in and knowledge of such critical topics as *adult* second-language acquisition, essential linguistic information on the nature of nonalphabetic and other types of

languages and writing systems and how they compare to an alphabetic system, the impact of cultural differences on learning, phonological skills as they relate to language and literacy acquisition, the reality of being nonliterate, mental health issues that relate to trauma, immigration and culture shock and cultural differences in viewing mental health issues, and issues that relate to problems in testing adult ELLs using tests in English.

b. Materials for reference on the above-mentioned topics should be made known to programs, created if necessary, and made available for teacher use.

Table 12.

Studies That Claim to Identify ELLs (FLLs) With LD/RD Through Some Type of Direct Testing

AGE GROUP	Total # of studies	Quantitative/qualitative	Comparative	Longitudinal	Size range of studies	# of studies w/ subjects >50	# of studies w/subjects > 100	Number of studies showing that language learners with difficulties (RD/LD/ learning difficulties) were identified by:											
								WK PA/ PM in NL	WK NL OP	Pos. corr. PS in 2 Ls	WK OP in 2 Ls	WK TL PS	WK TL OP	WK NL PM predicts TL learning	RAN in TL pred. RD	NL WM pred. TL RD	TL diff. ID's NL RD	Mediated teacher predictions	Other testing ID's LD or RD
Adult ESOL or Vols.	3	3/0	3	0	32-43	0	0	1	1	1	1	2	0	1	0	0	0	2	0
College FL	3	3/1*	2	0	4-89	2	0	3	1	3	0	1	0	0	0	0	0	0	0
School-age older (12-18 yrs.)	5	5/0	5	0	40-1,038	4	3	0	0	1	1	2	2	1	0	0	1	0	2
School-age mixed (5-18 yrs.)	4	4/0	3	3	54-89	4	0	0	0	2	1	0	1	1	0	0	0	0	0
School-age young (5-11 yrs.)	23	23/0	22	7	36-978	19	19	3	2	8	2	5	5	0	6	3	2	0	9
TOTALS	**38**	**38/1**	**10**	**10**	**--**	**29**	**22**	**7**	**4**	**15**	**5**	**10**	**8**	**3**	**6**	**3**	**3**	**2**	**11**

Abbreviations: ESOL = English to speakers of other languages; FL = foreign language; TL = target language (i.e., language being learned); PA = phonological awareness; PM = phonological memory; PS = phonological skills (both PA & PM); OP = orthographic processing (reading letters and words); WM = working memory; ID = identifies; WK = weakness; RD = reading difficulty (not always disability); RAN = rapid automatized naming (test of processing speed); Diff = difficulties; 2Ls = both languages of learner.

*Both elements in study.

"Other testing" includes use of an artificial language and testing of skills not mentioned here. Each was a single occurrence.

Table 13

Part A. Studies That Indicate That Direct Testing of ELLs for RD/LD May Present Problems

AGE GROUP	Total # of studies	Quantitative/qualitative	Comparative	Longitudinal	Size range of studies	Subjects >50	Subjects > 100	The paradigm for testing/referral is flawed for ELLs						In-test factors impact outcomes of ELLs (challenges to validity, reliability of tests)		
								Est. procedures not followed	Pych's. did not follow legal/prof. guidelines	Lang. testing not done or inaccurate	Diagnosis did not match evidence	Cultural issues or stereotyping	Disability not consistently observed	Complexity of language	Cultural bias of items	Incorrect test design
College-(not FL / ESOL)	1	1	0	0	117	1	1	0	0	0	0	0	0	0	0	0
School-age mixed (5-18 yrs.)	7	3/4	1	0	6—26 (Also*)	1	1	5	5	5	6	6	6	1 *	0	0
School-age young (5-11 yrs.)	3	3/0	3	0	69-369	3	2	0	0	0	1	0	0	1	1	1 **
TOTALS	**11**	**7/4**	**4**	**0**	**XX[[?]]**	**5**	**4**	**5**	**5**	**5**	**7**	**6**	**6**	**2**	**1**	**1**

* Meta-analysis of 36,000 and 25,000 scores of ELLs and non-ELLs on standardized achievement tests.
** Tests of oral proficiency found to be significantly flawed in concept and design.
Psych's = Psychologists who did testing/diagnosis.

Table 13

Part B. Studies That Indicate That Direct Testing of ELLs for RD/LD May Present Problems

AGE GROUP	Total # of studies	Quantitative/qualitative	Comparative	Longitudinal	Size range of studies	Subjects >50	Subjects > 100	Phonological skills not universal; cannot be reliably tested across language or orthographies				In-learner factors that could/do influence outcomes of ELLs on standardized tests							No prior literacy impacts PS	Other evidence of problems**
								NL/TL connection not found	PS language-specific after literacy	Phon. weakness not comparable.	Phon. memory not ID R	Stage of lang. acquisition	Prior education	Socioeconomic status	Orthographic processing	Cultural view of test items	MA of Eng differs by learner lang.	Other factors influence testing*		
Adult- ELL/ FLL or Vols.	13	12/1	12	0	24-192	11	2	0	0	1	1	8	2	0	2	0	0	6	2	4
College FL	4	4	4	0	34-105	3	2	0	0	0	0	0	2	0	1	0	1	2	0	0
School-age older (11-18 yrs.)	3	3	3	0	50-152	3	1	1	0	1	0	1	0	1	1	1	1	0	0	0
School-age mixed (5-18 yrs.)	8	8	7	2	67-251	8	6	0	1	0	1	2	1	0	2	1	0	0	0	1
School-age young (5-11 yrs.)	16	16	15	4	34-984	14	10	0	7	2	0	1	0	1	5	2	2	1	0	4
TOTALS	**44**	**43/1**	**41**	**6**	**--**	**39**	**21**	**1**	**8**	**4**	**2**	**12**	**5**	**2**	**11**	**4**	**4**	**9**	**2**	**9**

MA = morphological awareness.

* Other in-learner factors observed in one study each: Literacy transfer affected by culture, level of L1 skill maintenance; personal reason for learning impacts testing; age of language acquisition affected grammaticality judgment, ability to acquire grammar, ability to process affect words; articulatory awareness associated with low PA; culture influenced visual-spatial skill performance; individual frequency of exposure to native speakers impacted learning outcomes of FLL; variation in speed of reading between word and text in L2 for group of young ELLs.

** Other evidence of problems in testing: Frequency effect (frequency of usage of words used on testing significantly impacted learner outcomes); English orthography more difficult to acquire than other orthographies; RAN did not predict reading skill in L2; motor skills more important in *reading* Chinese than phonological skills

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Glossary

In-depth definitions of terms with an asterisk are given in Parts I and II. Other terms are explained in context when they are first used.

ABE: Adult basic education

ASE: Adult secondary education

BICS*: Basic interpersonal communication skills

CALP*: Cognitive academic language proficiency

CLD: Culturally and linguistically different (learners)

CPH*: Central processing hypothesis

ELL: English language learner

ESL: English as a second language

ESOL: English to speakers of other languages

ERP: Event-related potential

FL: Foreign language

FLLD: Foreign language learning difficulties (disability)

L1: First language

L2: The language a learner is learning, also TL (target language)

LDA: Learning Disabilities Association

LP: Language proficiency (usually first-language oral skills)

MA: Morphological awareness

NL: Native language (mother tongue or dominant language)

NWR*: Nonsense word repetition

OP*: Orthographic processing

PA*: Phonological awareness

PM*: Phonological memory

RAN*: Rapid automatized naming

RD*: Reading disability

SDH*: Script-dependent hypothesis

SLD: Specific learning disability

TL*: Target language (the language being learned)

WM: Working memory

Chapter 4
Accommodations: Evidence-Based Accomodation Research Specific to the Adolescent and Adult Population with Learning Disabilities

Noel Gregg

Introduction to Accommodations

One of the most significant barriers facing adolescents and adults with LD who are qualified to receive specific types of accommodations is the lack of professional knowledge pertaining to the research supporting the effectiveness of accommodations. Inadequate knowledge of the issues influencing the selection of valid accommodations results in either under- or over accommodation practices. However, providing adolescents and/or adults with LD accommodations often confronts long-held professional beliefs and practices. Definitions for constructs such as reading, writing, merit, equality, and fairness are all challenged when standardized learning and working practices are modified (Gregg, in press).

For instance, is speed a central construct being measured on a General Educational Development (GED) test, such that an administration of the measure with additional time alters the construct validity? Or is allowing a reader to assist an adolescent or adult with LD fair to other individuals? Unfortunately, many professionals still consider that one must read with one's eyes, not ears (e.g., read-alouds) to measure reading, or that paper/pencils must be used rather than speech-to-text software in order to really assess writing.

Accommodations used by adolescents and adults with LD provide equal access to and demonstration of knowledge. Throughout the literature, the terminology surrounding accommodation practices is not always consistently defined in the same way by professionals. Therefore, to ensure a mutual understanding of the accommodation terms discussed throughout this chapter, I have defined them in Table 14.

The purpose of this chapter is to provide the results of a review of empirically based evidence pertaining to the effectiveness of instructional and testing accommodations for adolescents and adults with LD. The majority of accommodation research studies using adolescent and/or adult participants with LD were found to be specific to testing accommodations. As no empirically based accommodation research was located that situated participants in the workplace, evidence from the

instructional and testing accommodation literature will need to be generalized to employment situations. However, professionals will need to remain somewhat cautious in making such inferences. A discussion of the implications of the accommodation literature for adults in the workforce is provided in the discussion section of this chapter.

RATIONALE FOR PROVIDING ACCOMMODATIONS

Clinical Rationale. Drawing upon an adolescent's or adult's unique profile when selecting accommodations enhances the probability of their effectiveness (Gregg, in press; Gregg & Lindstrom, 2008). In addition to recognizing individual differences (e.g., cognitive, affective, and linguistic processes), it is important to consider the task format (e.g., degree of structure, modality) and the response choices (e.g., written, oral) during the decision-making process. For instance, an adult's underachievement on a reading measure might be more directly related to problems with strategic planning than with phonemic awareness. Understanding the reason(s) for the underachievement will influence the effectiveness of the type of accommodation(s) chosen. Researchers have provided strong evidence that consistent and reliable professional judgment is essential to the accommodation process (Fuchs et al., 2000a; Hollenbeck, Tindal, & Almond, 1998).

Legal Rationale. The legal protection for adolescents and adults with LD to receive accommodations is provided by several legislative acts (14th Amendment of the Constitution; Title VI of the Civil Rights Act of 1964; Equal Educational Opportunities Act of 1974; Section 504 of the 1993 Rehabilitation Act; Americans with Disabilities Act (ADA); Individuals with Disabilities Education Act (IDEA), 1997, 2004; and No Child Left Behind (NCLB), 2001. Secondary students are protected by entitlement laws, whereas postsecondary educational or employment institutions operate under eligibility laws. In addition, the accommodation documentation requirements are not identical across sets of legislation. Therefore, there is no guarantee that if an individual with LD received accommodations in high school, he or she will be eligible for them at a postsecondary learning or work environment.

At the secondary level, adolescents with LD are provided rights under the Individuals with Disabilities Education Improvement Act (IDEIA) of 2004, which mandates that students with disabilities be provided appropriate accommodations across both instructional and testing situations. Students must have their accommodation needs specified in their Individualized Education Program (IEP). The IEP team determines if specific accommodations are consistent with federal and state guidelines. However, federal legislation protecting adolescents with LD cautions that only "appropriate accommodations, where necessary" (IDEA) and "reasonable accommodations necessary to measure academic achievement" (NCLB) be provided to a student.

The Americans with Disabilities Act and Section 504 of the Rehabilitation Act provide the legal support necessary for adults to access accommodations at postsecondary learning or work environments. Legally, to access an accommodation, an adult must demonstrate a "substantial limitation" as compared to "the general populations." (See Gregg, Coleman, Lindstrom, & Lee [2007] for an in-depth discussion of these constructs.) According to court rulings from the *Bartlett v. New York State Board of Law Examiners* (2001) and the *Turner v. Medical Examination Board* (2006) cases, accommodation decision making under ADA and Section 504 statutes must be based upon a comprehensive evaluation, and single test scores should not be used to support or reject access to specific accommodations. The court appears to look unfavorably at reliance on single cutoff scores and

favorably on clinical judgment for accommodation decision making (Gregg, in press). In other words, professionals should make the decision for specific accommodations based on the results of a comprehensive evaluation, and not simply rely on underachievement on academic scores from one or two measures.

Professional Standards Rationale. In addition to legal guidelines, professionals developing accommodation policy, procedures, and decision-making practices usually depend upon the *Standards for Educational and Psychological Testing* (American Psychological Association, American Educational Research Association, and National Council on Measurement in Education, 1999). The *Standards* recommend that professionals select accommodations based on existing research (*Standards* 10.2 and 10.8), and consistently follow clearly delineated policy describing the rationale and procedures for accommodation decision making, as well as possible limits on the validity of inferences that can be made (*Standards* 10.4 and 10.5). Score comparability (i.e., examinee scores with and without an accommodation) requires the investigation of measurement equivalence/invariance. A test fulfills measurement invariance when it is shown to measure the same attribute under different conditions (Meade & Lautenschlager, 2004). These conditions might include the stability of measurement across different populations and/or different methods of test administration. Tests of measurement equivalence/invariance are typically conducted with methodologies such as confirmatory factor analysis (CFA). Unfortunately, many companies publishing high-stakes tests do not have research available to demonstrate whether test scores taken by individuals with LD or ADHD using an accommodation (e.g., extended time) are comparable to individuals provided the extended time accommodation.

TYPES OF ACCOMMODATIONS

The four categories of accommodations most frequently utilized by professionals in both secondary and postsecondary settings are presentation, response, scheduling/timing, and setting (Gregg & Lindstrom, 2008). The National Center on Educational Outcomes (NCEO), a federally funded project, has maintained a systematic database on the participation of students with disabilities in large-scale testing programs since 1990. The NCEO provides professionals with a wealth of state-level data and other resources pertaining to state compliance and the accommodation of high-stakes testing (see http://www.education.umn.edu/NCEO/).

Presentation Accommodations. The purpose of a presentation accommodation is to provide an individual *access* to content, most often print material, by an alternative means (e.g., screen reader, access assistants [readers]), alternative media (e.g., electronic text, tape recorder), language structures (simplified syntax), and font format (e.g., large print). Read-alouds, the oral presentation of print, is a frequently requested accommodation across disabilities (Sireci, Li, & Scarpati, 2003; Thompson, Blount, & Thurlow, 2002).

Response Accommodations. Response accommodations allow an individual equal opportunity to *demonstrate* knowledge by using alternative forms (e.g., writing directly on a test booklet, oral response), providing access assistants (e.g., scribes), or employing speech-to-text software or other tools (e.g., word processor, calculator). Commonly requested technology response accommodations include word processing with spell-check; abbreviations expanders (programs that allow students to type abbreviations for frequently used words or phrases and press the space bar/mouse to select the complete word or phrase); and outlining software programs (Gregg, Morgan, Lindstrom, & Coleman, 2008).

Scheduling/Timing Accommodations. Scheduling/timing accommodations relate to adjustments to the time provided to complete an assignment or test (e.g., extended time, unlimited time, frequent breaks, testing over multiple days). Adolescents and adults with LD receiving extra time to complete a test have been studied more than any other accommodation (Gregg & Nelson, 2008).

Setting Accommodations. A setting accommodation is requested by an individual with disabilities to alter the instructional, testing, or employment situation (e.g., private room, quiet room, small-group setting). Although setting accommodations are often recommended by professionals for the adolescent and adult population with LD, the effectiveness of this accommodation consists primarily of only anecdotal evidence to support its use in practice.

A list of commonly used instructional and testing accommodations is provided in figure 1 as a resource for professionals to consider when working with adolescents or adults with LD. However, it is important for the reader to keep in mind that more empirical evidence is needed to validate the effectiveness of these accommodations across settings and learner profiles.

Instructional Accommodations—A Literature Search

Throughout the literature pertaining to instructional accommodations, it is very difficult to separate out whether researchers are measuring (a) a specific instructional technique, (b) an accommodation that enhances an instructional technique, or (c) an instructional technique and an accommodation measured as one construct. Usually, researchers investigating instructional techniques that involve accommodations (e.g., reading comprehension strategies and screen readers or composition-writing strategies and word processors) use academic outcomes as their indicator of effectiveness. Totally missing from the literature are studies in which "access competency" is a measured outcome indicator. In other words, what accommodations provide a learner with the ability to access learning (e.g., screen reader and electronic text) so that instruction can be enhanced? Instructional accommodations are not provided to "teach" a specific skill; rather, they are to provide access to instruction. Instructional accommodations should not be seen as replacing instruction. However, accommodation access coupled with effective instruction should lead to significant learning outcomes. A review of the literature pertaining to accommodated instruction is provided as an overview of current practice and future needs.

Computer searches of the PsycINFO, Medline, and ERIC databases for empirically based studies pertaining to instructional accommodations specific to the adolescent and adult populations with LD were conducted using the descriptors listed in appendix D. The first category of searches related to decision making was conducted to inform both the instructional and testing accommodation reviews as to empirically based research specific to the identification of LD for the adolescent and adult population. These articles focused on LD definitions, documentation guidelines, and eligibility criteria. A list of 147decision-making articles was initially identified and, from that list, 41 articles were specific to the adolescent and adult populations with LD (see appendix E, part 1, for final list).

In addition to the computer searches, hand searches of journals specific to these populations, going back 10 years, were conducted to ensure a

comprehensive review of the literature (see appendix F). For a study to be included in this review of instructional accommodations, participants had to be in the ninth grade (14 years old) or above and have received a diagnosis of LD. Individuals defined as "students with disabilities" were not included in the review.

READING INSTRUCTIONAL ACCOMMODATION RESEARCH

From the computer-based and journal hand searches, 250 articles were selected for review. From that group, 46 articles specific to the adolescent and adult populations with LD were selected based on the criteria discussed previously to inform a review of reading instructional accommodations (see appendix E, part 2). Of these 46 articles, 7 were empirically based reading studies in which instructional accommodations were investigated pertaining to the adolescent and/or adult populations with LD. Again, it was very difficult to separate an accommodation from an instructional strategy or intervention across the majority of these studies.

Decoding and Fluency. Instructional accommodations for reading decoding are discussed separately from those required for reading comprehension. Reading fluency will be discussed in relation to both decoding and comprehension, since it is integral to the success of both components of reading. However, several of the accommodation recommendations (e.g., extra time, private learning space) can be appropriate for either decoding or comprehension functional limitations. Extra time and a private room often are recommended accommodations for individuals demonstrating reading decoding problems. As difficulties with phonemic, orthographic, and syntactic awareness slow down the process of decoding, extra time becomes a critical accommodation for adolescents or adults with LD (dyslexia). There is a significant amount of research to support the need for this accommodation for adolescents and/or adults with LD (Gregg, in press; Shaywitz, 2003). However, no empirically based studies were located in this review that investigated the effectiveness of extra time on instructional assignments for the adolescent or adult populations with LD. Some individuals with LD (dyslexia) report that the ability to read aloud helps them monitor and attend to what they read. Therefore, a private room becomes necessary so that their oral reading does not bother other individuals in the classroom or work environment. Some readers with LD (dyslexia) even use earplugs or white noise machines to block out external sounds that interfere with their attending to and processing printed text (Shaywitz, 2003).

As a result of emerging technologies, a fundamental shift in how we define literacy is being witnessed in the world of school and work. For adolescents and adults with LD, these technologies offer opportunities to be better prepared for today's technology-rich schools and workplaces. A wide range of technologies are being used to accommodate the learning and work environments for these individuals. A glossary of technology terminology used throughout this paper is provided in table 15. In the area of reading, alternative media (alt media) and the software to access these formats are essential accommodations for adolescents and adults with LD. *Alt media* is a broad term that refers to a variety of formats into which printed text is converted (e.g., audiotaped text, enlarged print, electronic text, Braille).

The alt media used most commonly by adolescents or adults with LD demonstrating underachievement in reading include, but are not limited to, electronic text (eText) and audio files (Wolfe & Lee, 2007). eText is text made available in machine-readable or computerized formats. The type of file that eText is converted into also has significant impact on the type of technologies

and tools that integrate with it. For instance, a specific text-to-speech software program might not be compatible with the type of electronic format a book has been converted into from the printed text. Many text-to-speech software programs are not able to read from the Internet or a PDF file.

Regardless of the alt media format, eText is not accessible for individuals with LD unless it is used in conjunction with assistive technology software. Optical character recognition (OCR) software is first used to convert scanned or bit-mapped images of text into machine-readable form. The text may then be saved on magnetic media (e.g., hard drives) or on optical media (e.g., CD-ROMs). Text converted by OCR software is then read by text-to-speech (TTS) software. TTS is a type of speech-synthesis application that is used to create a spoken-sound version of the eText on a computer or handheld device. TTS can enable the reading of computer display information for an adolescent or adult with LD, or it may simply be used to augment the reading of a text message. Anderson-Inman & Horney (2007) prefer the term *supported e-text* to refer to the integration of eText with assistive software. An important feature of alt media is its portability. Digital files can be delivered to adolescents or adults via email or Internet portals and used in a variety of electronic and physical environments. Current advancements in technology now allow eText files to easily be downloaded not only to computers, but to handheld devices such as phones, personal digital assistants (PDAs), or MP3 players to be read through specialized TTS software.

Research evidence to support the effectiveness of eText and TTS software for enhancing the reading abilities of adolescents or adults with LD is currently limited in scope and depth (Anderson-Inman & Horney, 2007; Gregg, in press; MacArthur, Ferretti, Okolo, & Cavalier, 2001). However, even more disheartening is the fact that much of the TTS software cannot access or integrate with the various social media tools—from text messaging to blogging—that are becoming essential to success in school or the workplace. As colleges and universities are posting lectures on YouTube, and many chief executives of major companies are communicating to their employees and customers through blogs and Web pages, assistive technology software needs to integrate seamlessly with various forms of social media. The lack of empirically based evidence to identify effective technologies to provide adolescents and adults with LD access to reading online and offline (traditional print-based) is curious, given the explosion of technology in our society.

Comprehension and Rate. Reading comprehension underachievement, depending on the cognitive or linguistic source, can be more difficult to accommodate than decoding and reading fluency problems. However, current technology advancements are providing professionals with more tools than ever before to help adolescents or adults with functional limitations in reading comprehension. One promising technology software accommodation for reading instruction is embedded eText support. For example, MacArthur and Haynes (1995) investigated eText versions of a 10th-grade biology text in which the following embedded supports were evaluated: online notebook (notational resource); TTS and links to definitions; highlighting; and summaries of text. Many of the embedded supports significantly help readers with reading comprehension problems. Embedded supports used along with eText and TTS software might be more effective than eText or TTS alone for readers with LD. A growing body of research is providing strong validation for the effectiveness of embedded supports in enhancing reading comprehension for students with reading disorders (Anderson-Inman, 2004; Anderson-Inman & Horney, 2007; Anderson-Inman, Horney, Chen, &

Lewin, 1994; Horney & Anderson-Inman, 1994, 1999). However, a great deal more empirically based research is needed to determine the effectiveness of embedded supports for adolescents and adults with different types of reading profiles.

A promising technology for enhancing the reading comprehension of at-risk readers are the Web-based tutors that provide online self-explanation and metacognitive reading strategies. McNamara, O'Reilly, Rowe, Boonthum, & Levinstein (2007) developed one such program called the Interactive Strategy Training for Active Reading and Thinking (iSTART) and have provided strong research evidence to support its effectiveness. It is a Web-based tutoring program designed for adolescents and adults that uses animated agents to teach reading strategies. McNamara and colleagues found iSTART to be most beneficial to at-risk readers. However, at this time, no research is available to support its effectiveness with individuals diagnosed with LD. Again, the effectiveness of software such as iSTART depends upon its ease in successfully integrating with screen readers and other technologies necessary to access the online reading requirements of the program.

Extended time on reading comprehension assignments is a necessary accommodation for many individuals demonstrating reading comprehension underachievement. Difficulty decoding words, understanding vocabulary, or remaining sensitive to sentence or text structures often slows down the reading process for many adolescents or adults with LD. In addition, if any strategy or technology (e.g., read-aloud, embedded text) is used as an accommodation to assist the process of reading, extended time will be needed to implement such reading tools.

Color Filters and Reading. The use of color filters to enhance the reading proficiency of adolescents and adults with LD has not been validated by empirically based research. However, the interest and belief by many professionals that color overlays are effective in increasing reading fluency continues to receive attention in the literature (Fowler & Stein, 2005; Singleton & Henderson, 2007; Smith & Wilkins, 2007). In earlier studies, researchers suggested that color lenses would increase the reading competency of students with dyslexia (Robinson & Conway, 1990; Williams, LeCluyse, & Rock-Fauchesu, 1992). However, when evidence was not found specific to the population with dyslexia, the focus turned to suggesting its effectiveness for students with visual stress in reading, referred to as Meares-Irlen syndrome or scotopic sensitivity syndrome (Kriss & Evans, 2005). As normally achieving individuals also demonstrate this syndrome, it appears uncorrelated with reading disorders.

The connection between color filters and LD (dyslexia) rests with a hypothesis that dyslexia is the result of a deficiency in the magnocellular part of the visual system (Livingstone, Rosen, Drislane, & Galaburda, 1991; Stein & Walsch, 1997). However, empirical evidence to support a strong relationship between dyslexia and magnocellular deficits has not been validated (Ramus, 2001; Roach & Hogben, 2004; Skottun, 2000; Skottun & Skoyles, 2007). Over the years, different color filters have been proposed as effective in enhancing the reading fluency of individuals with reading disorders. For instance, some researchers promote the effectiveness of red or blue filters (Lehmkuhle, 1993; Solan, Ficarra, Brannan, & Rucker, 1998; Williams et al., 1992). Most recently, Ray, Fowler, and Stein (2005) suggest the use of yellow filters to increase reading fluency. However, Skottun and Skoyles (2007) provide strong evidence to challenge the relationship between color filters and reading performance. They conclude that red, blue, or yellow filters do not enhance magnocellular responses.

The majority of empirically based research related to the effectiveness of color filters on reading fluency has been with children. In addition,

these studies report very small numbers of participants, do not apply experimental designs, and do not report effect sizes (Kriss & Evans, 2005; Singleton & Henderson, 2007; Smith & Wilkins, 2007). Therefore, there is no evidence that color filters are effective in altering the reading performance of individuals with reading disorders.

WRITING INSTRUCTIONAL ACCOMMODATIONS

From the computer-based and journal hand searches, 325 articles were first identified specific to written expression; and from this group, 35 articles met the criteria discussed previously for inclusion in this literature review (see appendix E, part 3). Of those 35 studies, 11 presented empirically based evidence in which instructional accommodations were studied specific to the adolescent and adult populations. Again, it was very difficult to separate an accommodation from an instructional strategy in these studies.

Spelling. The persistence of spelling problems for individuals with LD (dyslexia) has been supported by a wealth of evidence (Berninger et al., 2006; Bruck, 1993; Coleman, Gregg, McLean, & Blair, 2009; Gregg, Coleman, Stennett, & Davis, 2002; Holmes & Malone, 2004). Therefore, extra time appears to be an appropriate accommodation for adolescents and adults with LD, since they require more time to recall the motor and orthographic patterns necessary to spell words (Gregg, Coleman, Davis, & Chalk, 2007). Word processing also appears to enhance the fluency and spelling of adolescent and young adult writers with LD (Bangert-Drowns, 1993; Goldberg, Russell, & Cook, 2003; Hetzroni & Shrieber, 2004; MacArthur, 2006. In addition, there is research that supports the effectiveness of spell-checkers and word prediction programs for enhancing the spelling performance of adolescent writers with LD (Handley-More, Deitz, Billingsley, & Coggins, 2003). Speech recognition software for dictation has also gained support as a means to enhance the writing of adolescents and adults with LD demonstrating spelling, handwriting, and fluency problems (Higgins & Raskind, 1995; MacArthur & Cavalier, 2004; Reese & Cumings, 1996).

Composition. A very important accommodation for writers experiencing difficulties producing written text is extended time (Gregg, in press; Gregg et al., 2007). Researchers continue to provide evidence that extended time can provide these individuals with a means to utilize strategies and/or technologies for improving their written products (Gregg et al, 2007). TTS and speech-to-text (STT) software also have potential for enhancing the production and revision of written text structure for at-risk writers (MacArthur, 2006). However, rather than the computer, handheld devices are fast becoming the essential hardware for communicating. For instance, MP3 players (e.g., iPods) with digital voice recorders have the potential to increase the writing proficiency of adolescents and adults with LD (Banerjee & Gregg, in press). Writers can dictate into their handheld digital voice recorders and then download text to their hardware of choice (e.g., laptop or handheld device). Spell-checks and word prediction software can be used during the editing phase of writing. The written text can then be read back (text-to-voice software) to the individual for correction and revision. Unfortunately, research documenting the effectiveness of such accommodation access tools for the adolescent and adult population with LD is not available at this time.

The effectiveness of teaching adolescent writers with LD to utilize procedural facilitators to enhance their writing competencies is well documented in the literature (Deshler, Ellis, & Lenz, 1996; Englert, Berry, & Dunsmor, 2001; Englert, Mariage, & Dunsmore, 2006; Graham & Harris, 2004; Hallenbeck, 1996). The majority of this research treats instruction and accommodation

as one construct. Therefore, I did not review the majority of this research, as I treated it as instructional research. However, professionals might consider how these tools, such as the think sheets advocated by Englert's *Cognitive Strategy Instruction in Writing*, can accommodate learning and testing situations for writers who struggle with the different aspects of writing (planning, organizing, drafting, editing, and author/reader relationship).

Unfortunately, the research on computerized software that provides strategic planning, organization, and revising prompts to adolescent and adult writers during the process of constructing text has produced more negative than positive results (Bonk & Reynolds, 1992; Reynolds & Bonk, 1996; Rowley, Carsons, & Miller, 1998; Rowley & Meyer, 2003; Zellermayer, Salomon, Globerson, & Givon, 1991). Interestingly, MacArthur (2006), in a review of assistive technologies and writing, states that he identified only one study (Sturm & Rankin-Erikson, 2002) that provides evidence for the effectiveness of concept-mapping software, despite its common use by professionals working with writers demonstrating writing disorders. However, this lack of research does not mean that it is not a valuable tool for enhancing the written text for an individual writer. It simply means we do not have enough empirical evidence to predict its effectiveness with the adolescent and/or adult population with LD.

MATHEMATICS

From the computer-based and journal hand searches, 106 articles were identified and, from this group, based on the criteria described previously, 25 articles specific to the adolescent and adult populations with LD were selected to review and inform a review of mathematics instructional accommodations (see appendix E, part4). Of those 25 articles, 1 presented empirically based studies in which instructional accommodations were studied specific to the adolescent and adult populations. Again, it was very difficult to separate an accommodation from an instructional strategy in these studies.

The four most commonly suggested instructional accommodations for math disorders are extra time, read-alouds, calculators, and concept or knowledge maps (Gregg, in press). However, very little research is available on the effectiveness of such accommodations, particularly for adolescents or adults with LD required to master higher-level math problems. There is ample research evidence that many individuals with LD should be provided extended time as a result of deficits in working memory, processing speed, lexical access, or language that impact their ability to quickly process mathematical information (Geary, 2007; Gregg, in press; Swanson & Jerman, 2006). The use of read-alouds and calculators to accommodate math is beginning to receive greater attention by professionals (Tindal & Ketterlin-Geller, 2004). However, most of this research is specific to test accommodations.

The use of concept maps or graphic organizers has also been suggested by some professionals as an appropriate accommodation for individuals with LD. However, little evidence is available to support such an accommodation for adolescents and/or adults with LD (math). As graphic organizers rely on visual-spatial reasoning skills and lend themselves to higher-level mathematics, their importance to specific subgroups of adolescent and adult populations requires greater attention by researchers. Ives (2007) provided evidence that graphic organizers applied to secondary algebra instruction for students with LD were very effective. However, a great deal more empirically based research is needed to explore the relationship between math disorders and effective instructional accommodations for the adolescent and adult populations.

Test Accommodations — A Literature Search

This section provides the results of my review of the literature specific to the effectiveness of test accommodations for the adolescent and adult populations with LD. Test accommodations are provided to remove construct-irrelevant barriers to test performance while maintaining the integrity of the construct (e.g., reading, math) being measured (Sireci et al., 2003). Therefore, providing testing accommodations to qualified individuals is designed to promote fairness in testing and lead to an accurate interpretation of an examinee's test scores (Sireci & Pitoniak, 2006). Controversy pertaining to providing a specific accommodation arises when there is reason to believe that the accommodation may change the test's construct, thus altering the comparability of scores derived from the accommodated test. The three major concerns related to tests taken with accommodations are whether the accommodation (a) alters the skill being measured, (b) precludes the comparison of scores among examinees, or (c) allows examinees without disabilities to benefit if they were granted the same accommodation (Gregg, in press; Lindstrom & Gregg, 2007; Sireci & Pitoniak, 2006).

Accommodations are assumed to have a beneficial influence on the test scores of examinees receiving them, but not to provide accommodated individuals with an advantage (Shepard, Taylor, & Betebenner, 1998; Zuriff, 2000). In response to this inference, some researchers propose the interaction hypothesis or maximum potential thesis be used to interpret score comparability. This hypothesis suggests that an accommodation should *only* benefit the test scores for students who need the accommodation, but should not benefit students who do not need the accommodation (Shepard, Taylor, & Betebenner, 1998; Zuriff, 2000). According to Sireci et al. (2003), the interaction hypothesis purports "that there is an interaction between accommodation condition [accommodated vs. standard test administration] and type of student [e.g., students with disabilities vs. students without disabilities] with respect to test performance" (p. 5). Another construct proposed to address the interpretation of test accommodations is the differential boost hypothesis, in which researchers argue that accommodations should improve the performance of students with disabilities to a significantly greater extent than they improve the performance of students without disabilities (Fuchs & Fuchs, 1999; Pitoniak & Royer, 2001).

In a thorough investigation of the accommodation literature, Sireci, Scarpati, and Li (2005) provide evidence of the problems associated with the interaction hypothesis and suggest that the construct be reexamined. They note that while extra time on a test can benefit all examinees, individuals with disabilities demonstrate significantly greater gains than their nondisabled peers. Therefore, for individuals with disabilities, the gain is significantly greater to warrant the accommodation. The Gregg and Nelson (2008) meta-analysis provides additional support that adolescents and adults with LD, when provided extended time on tests, gain significantly more benefit from the accommodation than their nondisabled peers.

EFFECTIVENESS OF TEST ACCOMMODATIONS FOR THE ADOLESCENT AND ADULT POPULATIONS WITH LD

The purpose of this section of the paper is to review the literature on the effectiveness of test accommodations specific to the adolescent and adult populations with LD. Therefore, only empirically based studies in which the effectiveness of testing accommodations specific to the adolescent

or adult populations with LD were included in the literature review.

A variety of approaches were used to identify the relevant studies. First, two computer searches of the PsycINFO database were conducted. The first search located 1,179 articles and the second, used for analysis, located 2,392 articles. The descriptors used were LD + accommodations (10 hits), LD filtered by adolescent age group (1,200 hits), and LD filtered by adult age group (1,100 hits). In addition, to ensure articles were not overlooked, searches were conducted on MEDLINE and ERIC databases. Next, a search was conducted of journals in which the majority of the articles were found and in journals related to any of the following topics: adolescents or adults with LD, learning disabilities, testing, accommodations, and measurement. A hand search of the last 10 years across these journals was conducted (see appendix F for the list of journals). In addition, a review of specific websites determined to be related to accommodation policies and practices was completed to identify any research not found in the database searches (see appendix G for the list of Web sites). Finally, published literature reviews specific to the accommodation of individuals with disabilities were identified (nine) and the research articles in these reviews were compared to the list from the database searches (see appendix H for the list of literature reviews and the number of studies reviewed from these documents).

A total of 134 potentially relevant studies were identified from all of these searches (see appendix I for the list of articles). These articles were then reviewed using a set of inclusion and exclusion criteria. All studies must have been published in peer-reviewed journals or had to be a technical research document from one of the major test publishers. No dissertations or ERIC documents were included in the analysis. Participants with LD in a study must have been in ninth grade (14 years of age) or higher, and they must have received the diagnosis of LD. Studies in which participants were identified only as "individuals with disabilities" were not included in this review. Studies were also excluded if the article failed to provide a comparison group or the research design was not experimental, quasi-experimental, nonexperimental, or a meta-analysis. Using these inclusion and exclusion criteria, 37 studies were identified for analysis (see appendix J for the list of studies). As these articles were reviewed, several more were found not to meet the criteria discussed above necessary for inclusion in this literature search. Appendix J also includes the specific rationale for rejecting these articles. The final list of studies (31) used for this review of the literature is included in appendix K. In addition to a general review of the literature, a meta-analysis of the data was conducted (Gregg & Nelson, 2008).

Of the 32 test accommodation studies identified in this literature search, 57% involved the performance of participants with and without LD on postsecondary college entrance examinations. Of the studies, 53% (17) investigated reading, 44% (14) math, and only one study investigated written language performance. For the purposes of this review, the verbal section on the SAT was coded as a reading measure. Three of the 32 studies investigated for this review used experimental, 8 used quasi-experimental, and 21 used nonexperimental designs. The majority of the studies were related to the effectiveness of extended time on academic test performance. Despite a thorough search of the literature, only three studies specific to the adolescent or adult populations with LD were found in which the effectiveness of read-aloud test accommodations was investigated (Calhoon, Fuchs, & Hamlett, 2000; Elbaum, 2007; Elbaum, Arguelles, Campbell, & Saleh, 2004). No additional studies were located in which other types of test accommodations were examined.

READING TESTS

The most frequently investigated test accommodations by researchers examining the performance of "individuals with disabilities" are read-alouds or extended time (Sireci et al., 2003; Thompson et al., 2002). Read-aloud technology, such as TTS or some other oral presentation of print (e.g., reader), are presentation accommodations that are often recommended by professionals for individuals with LD (dyslexia). As mentioned previously, the purpose of a presentation accommodation is to provide an adolescent or adults with LD access to information, most often print material, by using a combination of alternative media and assistive technologies.

However, the effectiveness of read-alouds for accommodating reading tests for students with disabilities is not supported by any conclusive positive or negative evidence (Calhoon et al., 2000; Elbaum, 2007; Fuchs et al., 2000a; Gregg, in press; Johnson, 2000; Kosciolek & Ysseldyke, 2000; Meloy, Deville, & Frisbee, 2002; Phillips, 2002; Sireci et al., 2003; Thompson et al., 2002; Tindal, Heath, Hollenbeck, Almond, & Harnis, 1998). What is quite disheartening is that only three read-aloud studies met the criteria discussed previously for inclusion in this review of the test accommodation literature specific to the adolescent or adult population with LD, despite the fact they are frequently recommended accommodations. The effectiveness of read-aloud technologies with eText has received no attention by researchers, despite the increasing use of eText on high-stakes tests.

It is important to recognize that the issue of accommodating an examinee taking a test designed to measure "reading competency" by using a read-aloud is very controversial. First, the use of read-alouds on reading tests challenges traditional definitions of the reading construct, which state that reading is defined by an individual reading print. Second, since the majority of reading tests were designed to measure reading using this traditional definition, the construct validity of a standardized reading measure is impacted. In a review of the validity issues surrounding the accommodation of the National Assessment of Educational Progress (NAEP), Sireci (2004) suggests that the use of read-alouds on reading tests is likely to change the construct measured. As mentioned previously, if the construct validity of a measure is changed as a result of an accommodation, test scores cannot be compared across populations (i.e., examinees with and without accommodations), and inferences pertaining to score interpretation are jeopardized. Unfortunately, in the Sireci literature review, "students with disabilities" were the participants investigated rather than any specific subgroups. In addition, the amount of instruction and strategy training on the use of read-aloud accommodations provided to examinees prior to NAEP testing was not controlled. Sireci (2004) does provide some suggestions on how to compare scores obtained with and without read-aloud accommodations, suggesting that they be treated as two different test forms and then equating them. He strongly encourages the creation of universal test designs (UTD) that make accommodation unnecessary.

Some researchers suggest that the read-aloud accommodation used with other accommodations might lead to better test performance than if a read-aloud is the only modification made to the testing situation. For instance, Calhoon et al. (2000) found that individuals with disabilities often do better on constructed-response items than multiple-choice items across different read-aloud formats; the read-aloud accommodation appears to have an indirect effect on performance. As read-aloud technologies and access to alt media formats continue to improve, and their use becomes more standard practice for individuals with reading disorders,

empirically based research on the effectiveness of read-aloud technology will continue to grow.

Scheduling/timing test accommodations relate to adjustments to the time provided to complete a test (e.g., extended time, unlimited time, frequent breaks, testing over multiple days). Students with disabilities receiving extra time on standardized tests have been studied more than any other accommodation (Chi & Pearson, 1999a, b; Sireci et al., 2003; Thompson et al., 2002). For many adolescents and adults with LD, extra time during test taking has proven to be an extremely effective accommodation (Gregg, in press). According to Sireci (2004), flexible time limits reduce unintended speededness effects and do not alter the construct validity of a test. In addition, several researchers provide evidence that extra time is not going to improve performance if an individual does not know the content (Cohen, Gregg, & Deng, 2005; Fuchs, Fuchs, Eaton, Hamlett, & Karns , 2000; Mandinach, Bridgeman, Cahalan-Laitusis, & Trapani, 2005). These research studies highlight the fact that accommodations are not a replacement for instruction but, rather, facilitate access or production of knowledge.

Recently, Lindstrom and Gregg (2007) investigated the factor structure of the newly revised Scholastic Aptitude Reasoning Test (SAT, 2005) across two groups of students (students without disabilities tested under standard time conditions, and students with LD and ADHD tested with extended time) to determine whether the test measures the same construct for both groups. Invariance across the two groups was supported for all parameters of interest, suggesting that the scores on the Critical Reading, Math, and Writing sections of the SAT Reasoning Test can be interpreted in the same way when students have an extended-time administration as opposed to the standard-time administration. Measurement invariance is often investigated using confirmatory factor analysis (CFA). More measurement invariance research is needed across other high-stakes tests (e.g., Graduate Record Examinations, graduation exit examinations) to determine whether or not the factor structure changes if extended time is provided to an examinee with LD. If it does not, it will be difficult to support the argument that when an examinee has extended time, the construct validity of the test scores is compromised.

WRITING TEST ACCOMMODATION RESEARCH

Written language disorders are symptomatic for a significantly large percentage of adolescents and adults with LD. Specific difficulties with handwriting, spelling, syntax, organization, and writing fluency are often characteristic of adolescent and/or adults with LD (Gregg, in press). Commonly requested accommodations on writing assessments by individuals with LD include extra time, word processors, spell-checks, word prediction software, and TTS technology (Gregg, Coleman, & Lindstrom, 2008).

The effectiveness of word processing as a test response accommodation for adolescents and/or adults with LD or ADHD has been inconclusive (Cahalan-Laitusis, 2003). Unfortunately, researchers reporting no difference in scores between word-processed or handwritten versions of timed essay writing reviewed studies conducted a decade or more ago (Hollenbeck, Tindal, Harniss, & Almond, 1999; MacArthur & Graham, 1987). Since that time, word processing and other technologies have been more integrated into school curriculums. Recently, Gregg et al. (2007) studied college writers with and without LD (dyslexia) required to handwrite a timed impromptu essay similar to tasks found on high-stakes writing tests (e.g., high school graduation tests, postsecondary entrance examinations). They investigated the influence of handwritten, typed, and typed edited formats on the quality scores of these writers.

Results from their research suggests that legibility problems can easily influence raters' perceptions of competence, because a writer who is slow and laborious in forming letters and words might sacrifice verbosity as well as ideation and planning time. Providing the response accommodation of word processing for many adolescents and adults with LD or ADHD appears to have strong empirical evidence.

As mentioned previously, there is ample research that supports the effectiveness of spell-checkers and word prediction programs for enhancing the spelling performance of adolescent writers with LD (Handley-More et al., 2003). Speech recognition software and text-to-speech software has also gained support as a means to enhance the writing of adolescents and adults with LD demonstrating spelling, handwriting, and fluency problems (Higgins & Raskind, 1995; MacArthur & Cavalier, 2004; Reese & Cumings, 1996). However, no empirically based evidence is currently available to support the effectiveness of this technology when used as an accommodation on writing tests.

Verbosity (i.e., productivity) is another critical construct to address in the evaluation of writing. Gregg et al. (2002) investigated the written discourse complexity of young adult writers with and without LD. They found that verbosity, quality, and lexical complexity scores across theses writers were significantly correlated. In fact, verbosity and quality in their research could not be viewed as separate constructs. Therefore, writers who produced shorter essays more often received lower-quality scores. In a more recent study investigating the timed essay writing of young adults with and without LD, Gregg et al. (2007) again found significant differences on the total number of words and the number of different words produced between writers with and without LD (dyslexia). In addition, they found significant differences between the groups on completion of the essay writing. Only 71% of the writers with LD completed writing their essay in a timed situation, whereas 91% of the writers without disabilities completed the writing task. There appears to be strong evidence to support a need for many adolescents and adults with LD to receive the accommodation of extended time on writing measures.

As mentioned previously, Lindstrom and Gregg (2007) investigated the factor structure of the writing section of the SAT and found invariance across examinees taking the test under standard administration and individuals with LD and ADHD taking it with extended time. Unfortunately, this was the only study identified in which the effectiveness of extended time as a writing test accommodation was investigated for the adolescent or adult population with LD.

MATHEMATICS TEST ACCOMMODATION RESEARCH

Three commonly suggested testing accommodations for math disorders are read-alouds, extra time, and calculators. However, very little research is available as to the effectiveness of such testing accommodations, particularly for adolescents or adults with LD. The use of read-alouds during math assessments is beginning to receive greater attention by professionals as a result of the increase in high-stakes tests in the world of school and work. Tindal and Ketterlin-Geller (2004), in a review of the research on mathematics test accommodations relevant to the NAEP, conclude that read-aloud accommodations benefit younger "students with disabilities" and "students with low reading skills." In addition, they suggest that the construct validity of mathematics tests is not altered when a read-aloud is used by a student.

There is ample research evidence to support that many individuals with LD should be provided extended time as a result of working memory, processing speed, lexical access, or language-based

deficits that impact their ability to quickly process mathematical information (Swanson & Jerman, 2006). However, the findings from research studies pertaining to the effectiveness of extended time as an accommodation on math tests for individuals with disabilities is somewhat unclear (Alster, 1997; Johnson, 2000; Munger & Loyd, 1991; Tindal & Ketterlin-Geller, 2004). As noted by Fuchs, Fuchs, Eaton, Hamlett, and Karns (2000), the majority of studies pertaining to the effectiveness of extra time on math tests for students, with and without LD, lack population specificity and usually have confounding treatment variables.

However, two recent studies provide professionals with a better understanding of the role of extended time for adolescents and adults with LD. Cohen et al. (2005) conducted two studies to investigate the influence of extended time and content knowledge on the performance of ninth-grade students who took a statewide mathematics tests with (n = 1,250) and without (n = 1,250) the accommodation of extended time only. Using a mixed differential item response (DIF) model, three very interesting results shed light on the issue of extended time as an accommodation for individuals with LD. The results from both studies suggest that adolescents for whom items were functioning differently were not accurately characterized by their accommodation status, but rather by their content knowledge. That is, knowing an examinee's accommodation status contributed little to understanding why accommodated or nonaccommodated individuals differed in their test performance. Rather, the data suggest that a more likely explanation is that mathematical competency differentiated the groups of learners regardless of their accommodation and/or reading levels. The findings do not suggest that extra time was not beneficial but, rather, that math knowledge and extended time significantly influence the scores for individuals with accommodations. The accommodation cannot replace deficits in math knowledge.

Lindstrom and Gregg (2007) found the use of extended time did not change the construct validity of the math section of the SAT for examinees with LD taking the measure with extended time. However, the total mean scores were significantly different across these two groups, with the examinees with LD scoring significantly lower than their peers with no disabilities. As with the Cohen et al. (2005) study, individual differences appear to be more the result of math competence, not the use of the extended time accommodation.

Research on the use of calculators during high-stakes math testing suggests that "the effect of calculator use differs by the item types included in the tests" rather than the characteristics of the population studied (Bridgeman, Harvey, & Braswell, 1995; Cohen & Kim, 1992; Loyd, 1991; Tindal & Ketterlin-Geller 2004). Therefore, the type of math item is the significant influence on the effectiveness of a calculator used during testing. For instance, Scheuneman, Camara, Cascallar, and Lawrence (2002) found that calculator use favored fraction items, but not reasoning items. Most interesting was their finding that calculator use was inversely related to test completion, and that more capable students use them more often than less capable students. In a thorough review of the literature investigating the research on mathematics tests accommodations relevant to NAEP testing, Tindal and Ketterlin-Geller (2004) conclude, "Research in mathematics testing accommodations highlights specific accommodations that function interactively by the characteristics of individual items and in reference to specific skills of individuals (not their disabilities)" (p. 10). However, no studies were identified in this review of the literature in which the effectiveness of calculators on math tests was investigated for the adolescent or adult populations with LD.

Meta-Study Summary

As mentioned previously, Gregg and Nelson (2008) conducted a meta-analysis on the studies collected for this review that pertained to the effect of the accommodation of extended time on the standardized administration of tests for adolescents and adults with LD. The results of these analyses suggest that adolescents or adults with LD benefit significantly more from receiving the accommodation of extended time than do their peers who demonstrate no disabilities. This finding supports the differential boost hypothesis and provides evidence for the effectiveness of extended time on reading, mathematics, and writing standardized test administrations for the adolescent and adult population with LD (Fuchs & Fuchs, 1999). In addition, Gregg and Nelson (2008) provide evidence that, despite receiving extended time on standardized test administrations, the population with LD continues to perform significantly below their peers academically. As noted by Cohen et al. (2005), accommodations are only one piece of providing access to learning for this population.

Implications for Practice

GENERAL

- ✓ The four categories of accommodations most frequently utilized by professionals in both secondary and postsecondary settings are presentation, response, scheduling/timing, and setting.
- ✓ Many of the current computer-based tests or instructional programs are not accessible to screen readers and other assistive technologies.
- ✓ The selection of effective test accommodations depends upon a professional's sensitivity to individual differences (e.g., cognitive and language processes), task format (e.g., structured, auditory modality, visual modality), and response choices (e.g., written, oral, reading).
- ✓ Test accommodations are provided to remove construct-irrelevant barriers to test performance while maintaining the integrity of the construct (e.g., reading, math) being measured (Sireci et al., 2003).
- ✓ The three major concerns related to tests taken with accommodations are whether the accommodation (a) alters the skill being measured, (b) precludes the comparison of scores among examinees, or (c) allows examinees without disabilities to benefit if they were granted the same accommodation.
- ✓ Accommodations are assumed to have a beneficial influence on the test scores of examinees receiving them, but not to provide accommodated individuals with an advantage.
- ✓ The documentation guidelines, eligibility criteria, and review processes are not identical across secondary and postsecondary settings. Therefore, one cannot assume that if an individual was provided specific accommodations in high school, that he or she will have access to those same accommodations in the postsecondary setting.
- ✓ The most frequently studied instructional or test accommodations by researchers investigating the performance of individuals with disabilities are read-alouds or extended time.

READING

- ✓ A significant amount of empirically based research is available to support the need for

adolescents and adults with LD to be provided the accommodations of extra time and a private learning space (e.g., room, cubicle) when reading is required. However, no empirically based studies were located that investigated the effectiveness of extra time or private learning spaces on reading assignments for the adolescent or adult populations with LD.

- ✓ The use of color filters to enhance the reading proficiency of adolescents and adults with LD has not been validated by empirically based research.
- ✓ Research evidence to support the effectiveness of eText and TTS software as an instructional or test accommodation for adolescents or adults with LD is currently not available.
- ✓ The majority of the speech-to-text software programs do not provide adolescents or adults with LD access to current technologies essential for functioning in the world of school or work (e.g., Internet, blogs, wikis).
- ✓ The most promising instructional reading accommodation with strong empirically based evidence to support its effectiveness for the adolescent and adult populations with LD is embedded eText supports. Embedded supports used along with eText and TTS software appear to be more effective than eText or TTS used alone for readers with LD (dyslexia).

WRITTEN LANGUAGE

- ✓ Research evidence is available to support the need for adolescents and adults with LD to be provided extra time on writing assignments or tests.
- ✓ Word processing appears to enhance the fluency and spelling of adolescent and adult writers with LD.
- ✓ Spell-checkers and word prediction programs appear to enhance the spelling performance of adolescent writers with LD.
- ✓ Speech recognition software for dictation has gained support as a means to enhance the writing of adolescents and adults with LD demonstrating spelling, handwriting, and fluency problems.
- ✓ Speech synthesis (text-to-speech) and speech recognition (speech-to-text) software also have potential for enhancing the production of written text for the adolescent and adult populations with LD.
- ✓ Research so far has shown that computerized software that provides strategic planning, organization, and revising prompts to adolescent and adult writers during the process of constructing text has produced more negative than positive results.

MATHEMATICS

- ✓ The four most commonly suggested instructional accommodations for math disorders are extra time, read-alouds, calculators, and concept or knowledge maps. However very little research is available as to the effectiveness of such accommodations, particularly for adolescents or adults with LD required to master higher-level math problems.
- ✓ Research evidence is available to support the need for many individuals with LD to be provided extended time as a result of working memory, processing speed, lexical access, or language-based deficits that impact their ability to quickly process mathematical information.
- ✓ The use of read-alouds and calculators for accommodating math instruction and testing is beginning to receive greater attention by professionals.
- ✓ The use of concept maps or graphic organizers has also been suggested by some professionals as an appropriate accommodation for individuals with LD (math). However, very little research is available at this time to support the effectiveness of this accommodation for instructional purposes for the adolescent or adult population with LD.

General Discussion

Accommodating adolescents and adults with LD is common practice across instructional, testing, and work settings. However, very little empirically based literature is available to support or reject the effectiveness of many of the accommodations provided to this population. Empirically based research specific to the accommodation of instruction and employment settings is significantly underrepresented in the literature. No empirically based studies in which work accommodations were investigated specific to the adolescent or adult population with LD were located during the searches. The effectiveness of instructional accommodations was represented by only 7 reading studies, 10 writing studies, and 1 mathematics study. Testing accommodation predominates in the literature, with 31 studies specific to the adolescent or adult population with LD. However, of these 31 studies, 57% were specific to the postsecondary entrance exams. The homogeneity of the participants across these studies does not accurately represent the heterogeneity of the adolescent and adult population with LD. Therefore, generalizing the results of the test accommodation literature to specific subgroups of the adolescent and adult population with LD (e.g., gender, race, ability level, education level) must be done with great caution.

The accommodation studied most often across the literature is extended time. Both the need for and the effectiveness of extended time for the adolescent and adult populations with LD is well supported by empirically based research. However, read-alouds, a frequently suggested accommodation for many individuals with print disabilities, has received very little empirically based research specific to the adolescent and adult population with LD. Hopefully, the child- oriented research ongoing at the National Accessible Reading Assessment Project (NARAP) (http://www.narap) will provide a precedent for future empirically based research specific to the adolescent and adult population with LD. Thurlow (2008) reported some NARAP research results from an experimentally designed study investigating the effectiveness of read-alouds on the test performance of fourth- and eighth-graders with and without LD. She found that, at both grades, the students with LD gained significantly more from using the read-aloud accommodation. Interestingly, she also found that the differential boost was larger in the fourth grade than in the eighth grade for the students with LD. Unfortunately, the vast amount of accommodations recommended to the adolescent and adult population with LD by professionals is supported by very little evidence-based practice as to its effectiveness.

UNIVERSAL DESIGN TESTS, LEARNING AND WORK ENVIRONMENTS

It appears that, in the future, the best solution to provide adolescents and adults with LD access to equal opportunities for learning and work would be universal test designs (UTD) and universal design learning (UDL) environments that would make accommodations unnecessary (Cohen et al., 2005; Sireci et al., 2005). The universal design (UD) concept was created to reflect the approach of proactively including accessible design features, while minimizing the need for individually retrofitted accommodations in learning and work environments. Many UD products and environmental features have become increasingly common in our lives: Closed captioning on television sets, which is useful for individuals with hearing impairments, also aids the average person in noisy environments such as airports or restaurants; curb cuts, which are useful for wheelchair users, also increase accessibility for other

individuals, including cyclists and parents with strollers. For a more comprehensive discussion of UDL or UTD, I suggest that the reader visit either the Center for Applied Technology at www.cast.org or the University of Washington's Web site at www.washington.edu/doit/Faculty/Strategies/Universal/.

WORLD OF WORK

In the corporate environment, businesses like Microsoft, Google, and Apple, Inc., have integrated UD accessibility features into their enterprise applications and/or project initiatives. For instance, Microsoft (http://www.microsoft.com/enable/) and Apple (http://www.apple.com/accessibility/) include accessibility options in their operating systems. These options provide a wide array of alternatives for accessibility and interaction, as current versions of Microsoft's and Apple's operating systems can include basic voice recognition, word prediction, and abbreviation software. Unfortunately, while the technology is often available to aid adults with LD with reading or writing tasks, many of these individuals receive little to no training in how to use these options.

Another excellent UD resource providing resources to adults is the Google Library Project, 2007 (http://books.google.com/googlebooks/library.html), which has partnered with public libraries to digitize and categorize public domain materials. While the decision by Google to digitally scan library books met with some opposition from the publishing community, it is a positive indicator that large companies like Google see the importance of providing their customers with access to digital media. Therefore, in the corporate environment, UD philosophy has been emphasized by focusing on the removal of barriers to technology. Many corporate environments are examining the value of integrating accessible technology into their organizations. For instance, John Cleghon, former chair and CEO of the RBC Financial Group, several years ago stated, "If you want to be a business leader and want access to top talent and enhanced market opportunity, you should absolutely promote accessibility" (Microsoft Corporation, 2002).

UNIVERSAL DESIGN MODELS FOR ACCESSING PRINT

As the result of reading underachievement, many adolescents and adults with LD face a substantial barrier that has a negative impact on postsecondary work and educational outcomes (Gregg, 2007; Wolf & Lee, 2007). Adolescent or adults who are unprepared or underprepared for the literacy demands of secondary and postsecondary learning environments have a high probability of dropping out, despite remedial instruction (Caverly, Nicholson, & Radcliffe, 2004; Gregg, 2007). Therefore, UD models that provide these individuals with digital media solutions for alternative means of accessing print are of critical need in both the education and work environments. However, for adolescents and/or adults who have reading difficulties, providing UD learning and work environments can pose a challenge. These individuals are often unfamiliar with the skills and strategies needed for reading in open learning environments (e.g., Internet).

Unfortunately, access approaches at the postsecondary level for individuals with LD have and continue to focus on primarily remedial interventions, tutorials, and/or nontechnology accommodations. Professionals working with adolescent and adult learners with LD must become better at empowering these individuals with knowledge—e.g., providing onsite and virtual training modules; offering hands-on direct instruction; providing access to today's tools for success, such as digital audio players (iPods), audio digital recorders (Belkin), and assistive technology software; ensuring availability of resources and materials (including print materials in digital format); and developing technical and learning supports via online

portals necessary to access information in real time. Too often, adolescents and adults with LD have to be satisfied with parallel reading experiences (i.e., read-only when the material is in an accessible medium, which may be available at a much later time), thereby precluding equal competitive opportunities in postsecondary learning or work environments. In other words, while accessibility might exist in some settings, it is often neither efficient nor effective.

Fortunately, a growing number of consumers, researchers, teachers, administrators, federal legislators, task groups, and technical assistance programs are forging strong alliances at the secondary and postsecondary level to advocate for the importance of alt media and assistive technologies for individuals with print disabilities (i.e., visual impairment, LD). For example, as a result of the 2004 Individuals with Disabilities Education Act (IDEIA), state departments of education now have the option to adopt the National Instructional Materials Accessibility Standard (NIMAS)(CAST, 200) for the purpose of providing instructional materials to blind persons or other persons with print disabilities in the K–12 setting (http://nimas.cast.org/).

Unfortunately, there are no federal laws requiring publishers of tests or textbooks to supply postsecondary educational or employment institutions with electronic copies of publications. However, in 2006, higher-education members of the Association of American Publishers (AAP) announced the launch of their Alternative Formats Solutions Initiative (http://www.publisherlookup.org/), a national effort to identify ways to supply print-disabled, postsecondary adults with alternative-formatted materials. In addition, several states have adopted alt media laws and/or guidelines to meet the challenges that adults face in postsecondary educational settings. Both California (www.atpc.com) and Georgia (www.amac.uga.edu) allocated a substantial amount of resources to support and implement statewide postsecondary alt media initiatives. It is essential that agencies providing services to adults through adult basic education programs become much more involved with helping individuals with LD access tests (e.g., GED, employment tests) and printed reading materials in alternative formats if these individuals are to be successful in the world of work.

eTEXT

eText is fast becoming the medium by which a large percentage of our society with or without print disabilities reads. One can buy an eText of a book, newspaper, or magazine and have it auto-delivered wirelessly to a laptop or handheld device in less than 1 minute. The process of reading is no longer solely defined by holding a book in one's hands and accessing meaning with one's eyes. However, eText is not accessible for many adolescents or adults with LD (dyslexia) unless it is used in conjunction with a product like TTS software. In addition, a growing body of research is providing strong validation for the effectiveness of embedded supports in enhancing reading comprehension for adolescents with LD (Anderson-Inman, 2004; Anderson-Inman & Horney, 2007; Anderson-Inman et al., 1994; Horney & Anderson-Inman, 1994, 1999). For further information about ongoing embedded eText research projects focusing on students with LD at the elementary or secondary level, the reader is directed to the National Center for Supported Electronic Text (http://ncset.uoregon.edu/). The implication of eText at the postsecondary level—for learning or work—has gone unexplored.

PORTABILITY AND THE HANDHELD LEARNING ENVIRONMENT

An important feature of eText for adolescents and adults with LD is its portability. Digital files can

be downloaded via e-mail or Internet portals and used in a variety of learning environments. Current advancements in TTS technology allow books and PDF files to be easily downloaded to computers or MP3 players, to then be read through specialized TTS software. In addition, STT technology, using such devices as digital recorders (e.g., Belkin audio recorders), provides a tool for adolescents or adults to instantly record their ideas or messages, which can then be downloaded into handheld devices that read information back to them.

Mobile phones are becoming the most dominant communication medium. More than half the population owns cell phones (more than 3.3 billion wireless users worldwide), as compared to 1.6 billion who own televisions (Ahonen & Moore, 2006). For adolescents or adults with LD, the phone is fast providing the most comprehensive accommodation tool for managing the reading and writing tasks facing them in the world of learning or work. For instance, the KNFB Mobile Reader, using the Nokia N-82 phone, allows individuals to scan text and either have it read to them immediately or downloaded as eText to their laptops. The implications for the learning and work environments are only beginning to be explored.

STRATEGIC USE OF ACCOMMODATIONS

Unfortunately, many individuals with LD are provided accommodations with very little training in how to strategically make use of them. A learning strategies approach in which an adolescent or adult is taught how and when to use an accommodation is essential to any kind of positive outcome. For instance, Brinckerhoff and Banerjee (2007) encourage training in active listening to accompany a student's introduction to eText. Accommodations such alt media (e.g., eText, audio text) and assistive technologies (e.g., TTS software) are often recommended for individuals with LD. While alt media and assistive technology software are necessary first steps to accessing print, examinees also need cognitive access in the form of explicit strategies for active engagement with the media (Gregg, in press). Individuals with LD who are provided extended time should also receive training to gain proficiency with learning strategies to help them learn how to best structure, manage, and organize time.

Learning is fluid and dynamic—it begins at a point of entry for knowledge and information. For most of us, that entry point is reading print. Whether between the bindings of a book or in cyberspace, print is still the primary mode of delivering and learning knowledge. Prior to the Americans with Disabilities Act (ADA), education for adolescents with LD often ended with high school; colleges and universities simply were not equipped to convert the complex array of text and other readings required for such students to complete course curriculums. Very few of these students even contemplated postsecondary educational opportunities. In the world of work, many of these individuals were underemployed or lost jobs when reading became essential to performance. Unfortunately, these many years later, the challenge is just as significant for many adolescents and adults with LD (Gregg, 2007). In light of the profound changes to literacy taking place in a digital, networked, multimodal, and multitasking world, the necessity for adolescents and adults with LD to have access to technology accommodations is critical. Accommodations are the access tools of the ADA; unfortunately, the toolbox is becoming dated as the postsecondary landscape changes under the influence of learning technologies (Banerjee & Gregg, in press; Gregg & Banerjee, 2009). Technology is redefining traditional concepts of accessibility and accommodations.

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Figure 1
Accommodation Options

(Gregg, in press)

Name: _____
Work: _____
Date: _____
Instruction: _____

Type of Accommodation	Reading		Math		Writing	
	Test	Instruct	Test	Instruct	Test	Instruct
Testing Accommodations						
1. Private Room						
2. Quiet Room						
3. Extended Time Reading 1.5						
4. Extended Time Reading > 1.5						
5. Extended Time Writing 1.5						
6. Extended Time Writing > 1,5						
7. Extended Time Math 1.5						
8. Extended Time > 1.5						
9. Scheduled Breaks						
10. Speech to Text						
11. Word Prediction						
10. Reader						
11. Interpreter						
12. Text to Speech						
13. Word Processor						
14. Proofreader						
15. Spell-Check						
16. Talking Word Processor						
17. Print/Computer Thesaurus						
18. Word Bank						
19. Non programmable Calculator						
13. Formula Sheet						
14. Write Directly on Test						

Type of Accommodation	Reading		Math		Writing	
	Test	Instruct	Test	Instruct	Test	Instruct
15. Written Instructions						
16. Computer Access Devises						
17. eText						
18. Modified Keyboard						
Instructional Accommodations						
19. eText						
19. Books on Tape						
20. Notetaker						
21. Digital/Tape Recorder						
22. Strategy and Accommodation						
23. Text to Voice						
24. Voice to Text						
25. Outline/Web Software						
26. Screen Magnification						
27. Computer Access Devices						
28. Modified Keyboard						
29. Listening Devices						
30. mp3 Player						
31. Extra Time						
32. Private Room or private space						
33. Embedded Text						
34. Hypertext/hypermedia						
35. Word processor						
Other						

Table 14
Accommodation Terminology

Term	Meaning
accommodation	Changes to instruction, testing, or work situations that allow an individual access to or demonstration of knowledge without altering standards or expectations.
assessment	Means to measure learning outcome; means to measure the learner.
differential boost hypothesis	Hypothesis that an accommodation should improve the performance of students with disabilities to a *significantly greater extent* than it improves the performance of students without disabilities.
instruction	Methods of teaching.
interaction hypothesis	Hypothesis that (a) when test accommodations are given to individuals with disabilities, their test scores will improve; and (b) students without disabilities will not exhibit higher scores when taking the test with those accommodations.
modification	Changes to instruction, testing, or work situations that alter standards or expectations.
read-alouds	Accommodations provided in which printed text is read aloud either by a person or technology (screen reader).
universal design learning (UDL)	*Multiple means of representation used* to provide various opportunities to acquire and demonstrate learning.
universal test design (UTD	Tests constructed and administered more flexibly so that accommodations become unnecessary.

Table 15
Technology Terminology

Term	Meaning
alternative media	Term that refers to a variety of formats into which printed text is converted (e.g., audiotape, Braille, electronic text).
ASCII text	Machine-readable text where only letters and punctuation are stored.
assistive technology	According to the United States Assistive Technology Act of 1998, assistive technology (also called adaptive technology) refers to any "product, device, or equipment, whether acquired commercially, modified or customized, that is used to maintain, increase, or improve the functional capabilities of individuals with disabilities."
blogs	Online content that provides commentary or news.
digital audio recorder (DAR)	Handheld device that records speech into a digital format to a computer or handheld device.
electronic text (eText)	Printed text made available on machine-readable or computerized formats.
Hypertext Markup Language (HTML)	Tagging system used to turn text into Web pages.
MP3	A digital audio encoding format. It is a common audio format for audio storage, as well as a de facto standard encoding for the transfer and playback of music on digital audio players (e.g., iPods).
online chat	Any kind of communication over the Internet, but primarily refers to chat between individuals or groups (e.g., AIM).
optical character recognition (OCR)	Software that converts scanned images of text into machine-readable formats.
social media	Internet media with interactive properties that enable a user to participate in a wide array of online activities.
speech-to-text software (STT)	Type of speech synthesis application used to translate speech to eText.
supported eText	Integration of eText with assistive technology software.
text messaging or texting	Term for sending text messages up to 169 characters from mobile phones.
text-to-speech software (TTS)	Type of speech synthesis application used to translate eText to speech.
wiki	Computer software allowing users to create, edit, and link Web pages.

Appendix D
Decision-Making and Instructional Accommodations Search Terms

Decision Making
measurement invariance research (intelligence, cognitive processing, language, and achievement measures) for specific populations
evidence-based decision making
clinical decision making
postsecondary documentation guidelines
functional limitations
eligibility criteria
cutoff criteria
discrepancy criteria
accommodation policies

Literacies and LD Adolescent and Adult Settings (secondary, postsecondary, employment)
instructional accommodations across types of literacy (reading, math, writing)
extra time and instructional accommodations
read-alouds and instructional accommodations
work accommodations
employment accommodations

Universal Design Learning and LD
Universal design (environment)
Universally designed learning
Alternative learning
Online learning
Nontraditional learning

Alternative Media and Assistive Technologies and LD
Alternative media
Alternative formats
eText
iPod learning
Podcast learning
Print disabilities
Assistive technologies
Read-alouds
Screen readers
Text formats

Appendix E

Decision-Making and Instructional Accommodation References Specific to Adolescents and Adults with LD

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Appendix F
Journals Hand Searched 1996–2007

Journal of Learning Disabilities

Learning Disabilities Quarterly

LD Research and Practice

LD: A Contemporary Journal

Annals of Dyslexia

Exceptional Children

Journal of Educational Measurement

Educational Measurement: Issues and Practice

American Educational Research Journal

Educational Evaluation and Policy Analysis

Educational Researcher

Review of Educational Research

Applied Measurement in Education

Adult Basic Education and Literacy Journal

Adult Education Quarterly Adults Learning

Journal of Adolescent and Adult Literacy

Journal of Literacy Resource

Reading Research Quarterly

Review of Adult Learning and Literacy

Appendix G
Websites Hand Searched for References

Center for Research on Evaluation, Standards, and Student Testing

National Center on Educational Outcomes

Behavior Research and Training National Center for Research and Evaluation

Student Testing Center for Assessment Validity and Evaluation

Wisconsin Center for Educational Research

Educational Testing Center (ETS)

General Educational Development Testing Service of American Council on Education

National Assessment of Educational Progress

Appendix H
Accommodation Literature Reviews Searched

Cahalan-Laitusis, C. (2003). Accommodations on high stakes writing tests for students with disabilities. Retrieved January 2004 from http://www.ets.org/accommodationsconference/ **[30 studies reviewed]**

Chi, C.W.T., & Pearson, P.D. (1999, June). *Synthesizing the effects of test accommodations for special education and limited English proficient students.* Paper presented at the National Conference on Large Scale Assessment, Snowbird, UT. **[30 studies reviewed]**

Johnstone, C.J., Altman, J., Thurlow, M.L., & Thompson, S.J. (2006). *A summary of research on the effects of test accommodations: 2002 through 2004* (Technical Report 45). Minneapolis, MN: University of Minnesota, National Center on Educational Outcomes. Retrieved November 11, 2007, from http://education.umn.edu/NCEO/OnlinePubs/Tech45/ **[46 studies reviewed]**

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Appendix I

Test Accommodation Reference Selection (134 references)

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Sireci, S.G., & Geisinger, K.F. (1998). Equity issues in employment testing. In J.H. Sandoval, C. Frisbee, K.F. Geisinger, J. Scheuneman, & J. Ramos-Grenier (Eds.), *Test interpretation and diversity* (pp. 105–140). Washington, DC: American Psychological Association.

Sireci, S.G., & Gonzalez, E.J. (2003, April). Evaluating the structural equivalence of test used in international comparisons of educational achievement. Paper presented at the Annual Meeting of the National Council on Measurement in Education, Chicago, IL.

Sireci, S.G., & Khaliq, S.N. (2002, April). *An analysis of the psychometric properties of*

dual language test forms. Paper presented at the Annual Meeting of the National Council on Measurement in Education, New Orleans, LA.

Sireci, S.G., Li, S., & Scarpati, S. (2003). *The effects of test accommodations on test performance: A review of the literature* (Research Report 485). Amherst, MA: Center for Educational Assessment.

Snyder, L.E., & Downey, D.M. (2001). Foreword. *Topics in Language Disorders, 21*(2).

Stiler, G.M. (2007). MP3 players: Applications and implications for the use of popular technology in secondary schools. *Education, 128,* 20–33.

Swain, C.R. (1997). *A comparison of computer-administered test and a paper and pencil test using normally achieving and mathematically disabled young children.* Unpublished dissertation, University of North Texas. *Abstracts International, 47,* 0125.

Thompson, S., Blount, A., & Thurlow, M. (2002). *A summary of research on the effects of test accommodations:1999 through 2001* (Technical Report 34). Minneapolis, MN: University of Minnesota, National Center on Educational Outcomes. Retrieved January 2003 from http://education.umn.edu/NCEO/OnlinePubs/Technical 34.htm

Thurlow, M.L., Hurley, C., Spicuzza, R., & Sawaf, H.E. (1996). *A review of the literature on testing accommodations for students with disabilities* (State Assessment Series Report 9). Minneapolis, MN: National Center on Educational Outcomes.

Thurlow, M., & Weiner, D. (2000). *Non-approved accommodations: Recommendations for use and reporting* (Policy Directions 11). Minneapolis, MN: University of Minnesota, National Center on Educational Outcomes.

Thurlow, M.L., Ysseldyke, J., & Silverstein, B. (1993). *Testing accommodations for students with disabilities: A review of the literature* (Synthesis Report No.4). Minneapolis, MN: National Center on Educational Outcomes.

Thurlow, M.L., Ysseldyke, J., & Silverstein, B. (1995). Testing accommodations for students with disabilities. *Remedial and Special Education, 16*(5), 260–270.

Thurlow, M.L., Ysseldyke, J., & Silverstein, B. (1998). *The research basis for the need for research on accommodations.* Paper presented at the American Education Research Association, San Diego, CA.

Tindal, G. (1998). *Models for understanding task comparability in accommodated testing.* Washington, DC: Council of Chief State School Officers.

Tindal, G. (2002). *Accommodating mathematics testing using a videotaped read aloud administration.* Washington, DC: Council of Chief State School Officers.

Tindal, G., Anderson, L., Helwig, R., Miller, S., & Glasgow, A. (1998, Summer). Accommodating students with learning disabilities on math tests using language simplification. *Exceptional Children, 64*, 459–70.

Tindal, G., & Fuchs, L. (1999). *A summary of research on test changes: An empirical basis for defining accommodations.* Lexington, KY: Mid-South Regional Resource Center, Interdisciplinary Human Development Institute.

Tindal, G., Heath, B., Hollenbeck, K., Almond, P., & Harniss, M. (1998). Accommodating student with disabilities on large-scale tests: An empirical study of student response and test administration demands. *Exceptional Children, 64*(4), 439–450.

Trimble, S. (1998). *Performance trends and use of accommodations on a statewide assessment: Students with disabilities in the KIRIS on-demand assessments from 1992–93 through 1995–96* (State Assessment Series, Maryland/Kentucky Report 3). Minneapolis, MN: National Center on Educational Outcomes; and Maryland State Department of Education, Baltimore, MD.

Waltz, L., Albus, D., Thompson, S., & Thurlow, M. (2000, December). *Effect of a multiple day test accommodation on the performance of special education students.* Minneapolis, MN: University of Minnesota, National Center on Educational Outcomes. Retrieved January 3, 2003, from http://education.umn.edu/NCEO/OnlinePubs/MnReport34.html

Weston, T.J. (1999 April). *The validity of oral presentation in testing.* Paper presented at the American Educational Research Association, Montreal, Canada.

Weston, T.J. (2002, July). *The validity of oral accommodation in testing.* Paper presented at the NAEP Validity Studies.

Wheeler, L.J., & McNutt, G. (1983). The effect of syntax on low-achieving students' abilities to solve mathematical word problems. *The Journal of Special Education, 17*(3), 309–329.

Wightman, L. (1993). *Test takers with disabilities: A summary of data from special administrations of the LSAT* (LSAC Research Report 93-03). Newton, PA: Law School Admissions Council.

Willingham, W.W., Ragosta, M., Bennett, R.E., Braun, H., Rock, D.A., & Powers, D.E. (1988). *Testing handicapped people.* Boston, MA: Allyn & Bacon.

Ziomek, R.L., & Andrews, K.M. (1998) *ACT assessment score gains of special-tested students who tested at least twice* (Report No. ACT-RR-98-8). Iowa City, IA: ACT Research Report Series.

Zurcher, R., & Bryant, D.P. (2001). The validity and comparability of entrance examination scores after accommodations are made for students with LD. *Journal of Learning Disabilities, 34*(5), 462–471.

Zuriff, G.E. (2000). Extra examination time for students with learning disabilities: An examination of the maximum potential thesis. *Applied Measurement in Education, 13*(1), 99–117.

Appendix J

Second Test Accommodation Selection– 37 Articles and Reason for Exclusion

Abedi, J., & Lord, C. (2001). The language factor in mathematics tests. *Applied Measurement in Education, 14*(3), 219–234. **[age not met; Students Without Disabilities (SWD) not LD][[define SWD?]]**

Ansley, T.N., & Forsyth, R.A. (1990). An investigation of the nature of the interaction of reading and computational abilities in solving mathematics word problems. *Applied Measurement in Education, 3*(4), 319–329. **[age not met; LD not identified]**

Allalouf, A., Hambleton, R.K., & Sireci, S.G. (1999). Identifying the causes of differential item functioning in translated verbal items. *Journal of Educational Measurement, 36,* 185–198. **[LD not identified]**

Alster, E. (1997). The effects of extended time on algebra test scores for college students with and without learning disabilities. *Journal of Learning Disabilities*, *30*(2), 222–227.

Barton, K.E., & Huynh, H. (2003). Patterns of errors made by students with disabilities on a reading test with oral reading administration. *Educational and Psychological Measurement, 63*(4), 602–614. **[SWD not LD]**

Bielinski, J., Thurlow, M., Ysseldyke, J., Friedebach, J., & Friedebach, M. (2001). *Read-aloud accommodations: Effects on multiple-choice reading and math items* (Technical Report 31). Minneapolis, MN: University of Minnesota, National Center on Educational Outcomes. Retrieved January 2004 from http://education.umn.edu/NCEO/OnlinePubs/Technical31.htm **[age not met]**

Braun, H., Ragosta, M., & Kaplan, B. (1986). *The predictive validity of the Scholastic Aptitude Test for disabled students* (Research Report 86-38). New York: College Entrance Examination Board.

Bridgeman, B., Harvey, A., & Braswell, J. (1995). Effects of calculator use on scores on a test of mathematical reasoning. *Journal of Educational Measurement*, *32*(4), 323–340.

Bridgeman, B., Trapani, C., & Curley, E. (in press). Impact of fewer questions per section on SAT 1 scores. *Journal of Educational Measurement, 41,* 291–310. **[LD not identified]**

Cahalan, C., Mandinach, E., & Camara, W. (2002). *Predictive validity of SAT I Reasoning Test for test takers with learning disabilities and extended time accommodations* (College Board Research Report, RR 2002-05). New York: College Board.

Calhoon, M.B., Fuchs, L.S., & Hamlett, C.L. (Fall 2000). Effects of computer-based test accommodations on mathematics performance assessments for secondary students with learning disabilities. *Learning Disability Quarterly, 23*(4), 271–282.

Camara, W., Copeland, T., & Rothchild, B. (1998). *Effects of extended time on the SAT I Reasoning Test: Score growth for students with learning disabilities* (College Board Research Report 98-7). New York: College Board.

Cohen, A.S., Gregg, N., & Deng, M. (2005). The role of extended time and item content on a high stakes mathematics test. *Learning Disabilities Research & Practice, 20*(4), 225–233.

Cohen, A.S., & Kim, A. (1992). Detecting calculator effects on item performance. *Applied Measurement in Education, 5*(4), 303–320. **[LD not identified]**

Crawford, L., & Tindal, G. (2004). Effects of a read-aloud modification on a standardized reading test. *Exceptionality, 12*(2), 89–106. **[age not met]**

Downey, D.M.., & Snyder, L.E. (2001). Curricular accommodations for college students with language learning disabilities. *Topics in Language Disorders, 21*(2), 55–67. **[not empirically based]**

Elbaum, B. (2007). Effects of an oral testing accommodation on the mathematics performance of secondary students with and without learning disabilities. *The Journal of Special Education, 40*(4), 218–229.

Elbaum, B., Arguelles, M.E., Campbell, Y., & Saleh, M. (2004). Effects of a student-reads-aloud accommodation on the performance of students with and without learning disabilities on a test of reading comprehension. *Exceptionality, 12*(2), 71–87.

Elliott, S., Kratochwill, T., & McKevitt, B. (2001). Experimental analysis of the effects of testing accommodations on the scores of students with and without disabilities. *Journal of School Psychology, 39*, 3–24. **[age not met; LD not identified]**

George-Ezzelle, C.E., & Skaggs, G. (2004, April). *Examining the validity of GED test scores with scheduling and setting accommodations.* Paper presented at the annual conference of the National Council on Measurement in Education. **[SWD not LD]**

Gregg, N., Coleman, C., Davis, M., & Chalk, J.C. (2007). Timed essay writing: Implications for high-stakes tests. *Journal of Learning Disabilities, 40*(4), 306–318.

Hanson, K., Brown, B., Levine, R., & Garcia, T. (2001). Should standard calculators be provided in testing situations? An investigation of performance and preference differences. *Applied Measurement in Education, 14*(1), 59–72. **[age not met; LD not identified]**

Helwig, R., & Tindal, G. (2003). An experimental analysis of accommodation decisions on large-scale mathematics tests. *Exceptional Children, 69*, 211–225. **[teacher perceptions; SWD not LD]**

Huynh, H., & Barton, K.E. (2006). Performance of students with disabilities under regular and oral administration of a high-stakes reading examination. *Applied Measurement in Education, 19*(1), 21–39. **[SWD not LD]**

Johnson, E.S. (2000). The effects of accommodations in performance assessments. *Remedial and Special Education, 21*(5), 261–267. **[age not met]**

Johnson, E., Kimball, K., & Brown, S.O. (2001). American Sign Language as an accommodation during standard-based assessments. *Assessment for Effective Intervention, 26*(2), 39–47. **[LD not identified]**

Koretz, D., & Hamilton, L. (2001, April). *The performance of students with disabilities*

on New York's revised Regents comprehensive examination in English (CSE Technical Report 540). Los Angeles: National Center for Research on Evaluation, Standards, and Student Testing, University of California, Los Angeles.

Kosciolek, S., & Ysseldyke, J.E. (2000). *Effects of a reading accommodation on the validity of a reading test* (Technical Report 28). Minneapolis, MN: University of Minnesota, National Center on Educational Outcomes. Retrieved January 2003 from http://education.umn.edu/NCEO/OnlinePubs/Technical28.htm **[age not met]**

Lesaux, N.K., Pearson, M.R., & Siegel, L.S. (2006). The effects of timed and un-timed testing conditions on the reading comprehension performance of adults with reading disabilities. *Reading and Writing, 19*(1), 21–48.

Lindstrom, J.H., & Gregg, N. (2007). The role of extended time on the SAT for students with learning disabilities and/or attention-deficit/hyperactivity disorder. *Learning Disabilities Research & Practice, 22*(2), 85–95.

Loyd, B.H. (1991). Mathematics test performance: The effects of item type and calculator use. *Applied Measurement in Education, 4*(1), 11–22. **[LD not identified]**

Ofiesh, N., Mather, N., & Russell, A. (2005). Using speed for cognitive, reading, and academic measures to determine the need for extended test time among university students with learning disabilities. *Journal of Psychoeducational Assessment, 23,* 35–52.

Rivera, C., & Stansfield, C.W. (2003–2004). The effects of linguistic simplification of science test items on performance of limited English proficient and monolingual English-speaking students. *Educational Assessment, 9*(3–4), 79–105. **[age not met; LD not identified]**

Scheuneman, J.D., Camara, W.J., Cascallar, C.W., & Lawrence, I. (2002). Calculator access, use, and type in relation to performance on the SAT 1 Reasoning Test in mathematics. *Applied Measurement in Education, 15*(1), 95–112. **[LD not identified]**

Tindal, G., Heath, B., Hollenbeck, K., Almond, P., & Harniss, M. (1998). Accommodating student with disabilities on large-scale tests: An empirical study of student response and test administration demands. *Exceptional Children, 64*(4), 439–450. **[age not met; LD not identified]**

Wheeler, L.J., & McNutt, G. (1983). The effect of syntax on low-achieving students' abilities to solve mathematical word problems. *The Journal of Special Education, 17*(3), 309–329. **[age not met; LD not identified]**

Zurcher, R., & Bryant, D.P. (2001). The validity and comparability of entrance examination scores after accommodations are made for students with LD. *Journal of Learning Disabilities, 34*(5), 462–471.

Appendix K

Final Test Accommodation Studies (31 studies)

Alster, E. (1997). The effects of extended time on algebra test scores for college students with and without learning disabilities. *Journal of Learning Disabilities*, *30*(2), 222–227.

Braun, H., Ragosta, M., & Kaplan, B. (1986). *The predictive validity of the Scholastic Aptitude Test for disabled students* (Research Report 86-38). New York: College Entrance Examination Board. [verbal]

Braun, H., Ragosta, M., & Kaplan, B. (1986). *The predictive validity of the Scholastic Aptitude Test for disabled students* (Research Report 86-38). New York: College Entrance Examination Board. [math]

Cahalan, C., Mandinach, E., & Camara, W. (2002). *Predictive validity of SAT I Reasoning Test for test takers with learning disabilities and extended time accommodations* (College Board Research Report, RR 2002-05). New York: College Board.

Calhoon, M.B., Fuchs, L.S., & Hamlett, C.L. (2000, Fall). Effects of computer-based test accommodations on mathematics performance assessments for secondary students with learning disabilities. *Learning Disability Quarterly, 23*(4), 271–282.

Camara, W., Copeland, T., & Rothchild, B. (1998). *Effects of extended time on the SAT I Reasoning Test: Score growth for students with learning disabilities* (College Board Research Report 98-7). New York: College Board. [SWD, standard administration, verbal]

Camara, W., Copeland, T., & Rothchild, B. (1998). *Effects of extended time on the SAT I Reasoning Test: Score growth for students with learning disabilities* (College Board Research Report 98-7). New York: College Board. [LD, standard administration, verbal]

Camara, W., Copeland, T., & Rothchild, B. (1998). *Effects of extended time on the SAT I Reasoning Test: Score growth for students with learning disabilities* (College Board Research Report 98-7). New York: College Board. [SWD, standard administration, math]

Camara, W., Copeland, T., & Rothchild, B. (1998). *Effects of extended time on the SAT I Reasoning Test: Score growth for students with learning disabilities* (College Board Research Report 98-7). New York: College Board. [LD, standard administration, math]

Camara, W., Copeland, T., & Rothchild, B. (1998). *Effects of extended time on the SAT I Reasoning Test: Score growth for students with learning disabilities* (College Board Research Report 98-7). New York: College Board. [LD, accommodation administration, verbal]

Camara, W., Copeland, T., & Rothchild, B. (1998). *Effects of extended time on the SAT I Reasoning Test: Score growth for students with learning disabilities* (College Board Research Report 98-7). New York: College Board. [SWD, accommodation administration, verbal]

Camara, W., Copeland, T., & Rothchild, B. (1998). *Effects of extended time on the SAT I Reasoning Test: Score growth for students with learning disabilities* (College Board Research Report 98-7). New York: College Board. [SWD, accommodation administration, math]

Camara, W., Copeland, T., & Rothchild, B. (1998). *Effects of extended time on the SAT I Reasoning Test: Score growth for students with learning disabilities* (College Board Research Report 98-7). New York: College Board. [LD, accommodation administration, math]

Cohen, A.S., Gregg, N., & Deng, M. (2005). The role of extended time and item content on a high stakes mathematics test. *Learning Disabilities Research & Practice, 20*(4), 225–233.

Elbaum, B. (2007). Effects of an oral testing accommodation on the mathematics performance of secondary students with and without learning disabilities. *The Journal of Special Education, 40*(4), 218–229.

Koretz, D., & Hamilton, L. (2001). *The performance of students with disabilities on New York's revised Regents comprehensive examination in English* (CSE Technical Report 540). Los Angeles: National Center for Research on Evaluation, Standards, and Student Testing, University of California, Los Angeles.

Lesaux, N.K., Pearson, M.R., & Siegel, L.S. (2006). The effects of timed and un-timed testing conditions on the reading comprehension performance of adults with reading disabilities. *Reading and Writing, 19*(1), 21–48.

Lindstrom, J.H., & Gregg, N. (2007). The role of extended time on the SAT for students with learning disabilities and/or attention-deficit/hyperactivity disorder. *Learning Disabilities Research & Practice, 22*(2), 85–95. [verbal]

Lindstrom, J.H., & Gregg, N. (2007). The role of extended time on the SAT for students with learning disabilities and/or attention-deficit/hyperactivity disorder. *Learning Disabilities Research & Practice, 22*(2), 85–95. [math]

Lindstrom, J.H., & Gregg, N. (2007). The role of extended time on the SAT for students with learning disabilities and/or attention-deficit/hyperactivity disorder. *Learning Disabilities Research & Practice, 22*(2), 85–95. [writing]

Ofiesh, N., Mather, N., & Russell, A. (2005). Using speed for cognitive, reading, and academic measures to determine the need for extended test time among university students with learning disabilities. *Journal of Psychoeducational Assessment, 23,* 35–52.

Zurcher, R., & Bryant, D.P. (2001). The validity and comparability of entrance examination scores after accommodations are made for students with LD. *Journal of Learning Disabilities, 34*(5), 462–471.

Chapter 5
Teaching Methods: Instructional Methods and Arrangements Effective for Adults with Learning Disabilities

Michael Hock

Introduction

In America, there is a fundamental belief that all children should learn the basics of reading in the primary grades and continue to build on those skills throughout school and into adulthood (Snow, 2002). In reality, however, millions of high school students do not read well enough to understand their textbooks or other material written for their grade level. According to the National Assessment of Educational Progress (NAEP, 2005), 26% of these students cannot read material essential for daily living, such as road signs, newspapers, or bus schedules. In addition, the National Adult Literacy Survey (NALS) indicated that about 50% of adults perform in the two lowest levels of functional literacy (Kirsch, Jungeblut, Jenkins, & Kolstad, 1993). The National Assessment of Adult Literacy (NAAL) finds no significant improvements between the 1993 and 2003 assessment scores for prose, document, and quantitative skills. In fact, skills for prose and document literacy significantly declined, and 43% of the adults who took the 2003 NAAL scored at the Basic or Below Basic levels (Kutner et al., 2007). Students unable to handle the demands they face in high school will certainly struggle in postsecondary education (Heiman & Precel, 2003; Hock & Mellard, 2005; Sitlington & Frank, 1990). In addition, if these reading problems are allowed to persist into adulthood, the consequences for individuals can be formidable.

The literacy challenges for adults with learning disabilities are even greater, as adults with LD tend to struggle with literacy more than their non-LD peers (Ransby & Swanson, 2003; Tractenberg , 2002) and in attaining positive academic outcomes in general (Gregg, 2007).

Importantly, the number of adults with LD in adult basic education (ABE) programs may be high. For adults with LD who attend ABE programs, estimates range from 3% of the population (Kirsch, Jungeblut, Jenkins, & Kolstad, 2002) to as high as 78% of the population (Keefe & Meyer, 1988). Other researchers have found the incidence of adults with LD in job training programs to be about 15%–20% (U.S. Employment and Training Administration, 1991). Further, in a survey of ABE program directors, prevalence of adults with LD estimates ranged from a low of 10% to a high of 50% (Ryan & Price, 1993). Finally, Kutner, Greenberg, and Baer (2006) reported an adult

population disability rate of 30% with 6% of those self-reporting LD. While the exact prevalence rate is difficult to determine, significant numbers of adults in ABE programs are likely to have a learning disability.

The skill profile of adults with LD indicates that they are among the lowest performers on measures of literacy. For example, adults with LD who participated in a descriptive study of reading component skills scored significantly lower than their non-LD peers. Specifically, on multiple measures of reading comprehension, adults with LD had a mean reading score at the third-grade level, while adults without LD read at the fifth-grade level (Mellard & Patterson, 2008). In an analysis of the National Adult Literacy Survey (NALS) data, 58% of adults who reported learning disabilities performed at Level 1 on the prose scale and another 22% performed at Level 2, the two lowest levels of the measure (Kirsch, Jungeblut, Jenkins, & Kolstad, 1993). These are the lowest levels of performance and show that these adults will have difficulty with the most basic of literacy tasks. Together with the more recent Mellard and Patterson study (2008), these findings suggest that the vast majority of adults with LD may need intensive basic skills instruction. Clearly, significant instructional challenges exist for adults who struggle with literacy issues, and those challenges can be greater for adults with LD.

WHAT IS LITERACY?

In this chapter, the overarching goal is to review the literature on adults with LD and identify evidence-based instructional practices that significantly narrow the literacy achievement gap for this population. For the purpose of this chapter, the definition of literacy as identified in the Workforce Investment Act, Section 203(12), will be used. The term *literacy* is defined to mean "an individual's ability to read, write, and speak in English, compute, and solve problems, at levels of proficiency necessary to function on the job, in the family of the individual, and in society" (Workforce Investment Act, 1998). This definition supports the goal that all U.S. adults be prepared to successfully perform literacy tasks that allow them to function in society by meeting personal and employment goals as well as making contributions to the community at large (White & Dillow, 2005).

Our focus in this review will be on the multiple instructional factors that have been shown to impact literacy outcomes for adults with LD. This review supplements recent work published by the National Institute for Literacy's Adult Literacy Research Working Group that provides a comprehensive review of evidence-based research on adult literacy instruction with reading as the targeted literacy area. This work includes *Applying Research in Reading Instruction for Adults: First Steps for Teachers* (McShane, 2005), *Research-based Principles for Adult Basic Education Reading Instruction, Applying Research* (Kruidenier, 2002); and *Teaching Adults to Read: A Summary of Scientifically Based Research Principles*. (Curtis & Kruidenier, 2005). These reports provide a complete and up-to-date review of the literature on reading instruction for adults.

The research reviewed in this chapter was evaluated through the theoretical lens of information processing for individuals with learning disabilities. Briefly, a framework with several key components underpins information processing theory. These components are (a) the learner's ability to process information effectively and efficiently, (b) the learner's ability to use various approaches to problem solving, and (c) an executive or metacognitive process that supports the learner's ability to control and monitor the effectiveness of learning (Swanson, 1987; Torgesen, 1986). Related to the learner's ability to process information effectively and efficiently are constructs like sensory storage, short-term memory, and long-term memory. Another component, the ability of the learner to use various approaches or strategies to problem solve is central to the studies we review. Knowledge about strategies and how to use them is the component

that is responsive to instruction. Often, adults with LD are described as lacking fluency with a variety of strategies that expert learners use when they approach academic tasks. These strategies include multiple and related strategies for reading, writing, speaking, remembering, and using these strategies to learn specific content. Finally, while knowledge of a variety of literacy strategies is important, knowing when, where, and how to use strategies as well as knowing how to monitor the effectiveness of strategies is central to effective learning. Thus, the studies reviewed here are linked to the theoretical model just described, instruction related to strategy acquisition and generalization, and self-regulated or metacognitive learning.

WHAT ARE THE LITERACY SKILLS OF ADULTS WITH LEARNING DISABILITIES?

Understanding the literacy skill profile of adults with LD is central to developing effective instruction. Recently, several descriptive studies have been conducted of adults attending adult basic education and GED programs (e.g., Mellard & Patterson, 2008; http://www.ed.gov/about/offices/list/ovae/news/alrn.html). These studies shed light on the nature of the literacy skills of adults in adult basic education programs, including adults with LD. For example, in a descriptive study reported by Mellard and Patterson (2008), 311 adult learners were administered a comprehensive battery of reading component and learner characteristic measures. The researchers found that 29% of the participants in the study self-reported having a LD. In analyzing the data, the researchers found that the mean scores of the adults with self-reported LD were significantly different and lower on multiple measures of literacy than the general population attending adult education centers. For example, 84% of the LD group reported difficulty reading as a child, and 75% received remedial help in school. Only 46% of the non-LD adults stated they had reading problems when younger, and 25% reported receiving remedial support. Additionally, adult education participants with LD scored 10% to 25% lower on measures of reading comprehension than participants without LD. These findings inform our knowledge about the characteristics of adult learners and the instructional methods needed to intervene and close the achievement gap. Given the skill profile of learners in adult education (AE) programs, well-designed instruction must be provided to learners attending AE centers.

Literature Search

Several key questions guided this review of evidence-based practices. The first question was, "What evidence-based interventions and practices are available to practitioners who work with adults with LD?" The second question was, "How can we best deliver instruction to adults with LD?" Finally, and in order to supplement the limited database on adults with LD, we asked, "What research-based instructional practices have been found to be effective with adolescents with LD that hold promise for adults with LD?" Each question was explored by reviewing research on adolescents and adults with LD and research that focused on effective instructional principles related to literacy.

Given the limited nature of the extant research on instructional methods for adults with learning disabilities, the search also highlights the considerable body of research-based instructional practices that have been found to be effective with adolescents with LD and, therefore, possibly foundational to instruction with adults with LD. We evaluated this body of

research for applicability to the adult population, taking care to note the differences between children and adults and to fill gaps in the adult literacy research base. Our primary criterion for deciding appropriateness of the adolescent literacy research was to focus on research conducted with older adolescents, as there is age overlap between older adolescents (ages 14 and up) and adults (ages 16 and older).

DATA COLLECTION

To compile this review of the literature, computer searches of the ERIC, PsycINFO, Proquest Dissertations, and MedlinePlus databases were conducted for articles published between the years 1990 and 2008. To conduct each search, the following descriptors were used in various combinations to capture the greatest number of articles: *Adults with learning disabilities* and the terms *literacy, reading, math, spelling, language arts, decoding, reading comprehension, fluency, word-level skills, vocabulary, instruction, intervention, treatment, training, teaching methods, direct instruction, explicit instruction, instructional effectiveness, achievement gap, closing the gap, small-group instruction, large-group instruction, learning style, constructivist, low literacy, tutoring,* and *writing.*

Some search terms resulted in numerous "hits" that, upon close examination, had little or no evidence base. For example, the term *learning styles* surfaced during the search. Learning styles is a notion that has strong face validity in the field and purports that teachers should teach to individual student strength in learning styles by using visual, auditory, or kinesthetic modes. However, researchers have not been able to find (1) significant reasons why visual, auditory, or kinesthetic approaches are the only effective instructional modes, (2) tests of learning styles that are reliable and valid, or (3) teaching methods aligned with learning style instruction that have been proven effective in rigorous studies (Druckman & Swets, 1988; Hudak, 1985; Mackeracher & Tuijnman, 1996; Metcalfe & Shimamura, 1996; National Adult Literacy and Learning Disabilities Center, 1999; Sticht, 1969; Sticht, 1972; Venezky, Oney, Sabatini, & Jain, 1998). Such practices, while often popular in the field, should be implemented with caution given the lack of supporting intervention evidence. Given the lack of evidence supporting identifying and teaching to individual learning styles, practitioners should consider using evidence-based practices like explicit instruction when teaching adult struggling learners. Explicit instruction has been found to be effective with a multitude of adolescent and adult struggling learners. When learning styles interventions are implemented, they should be evaluated carefully to ensure that important student outcomes are positive.

Additionally, we searched the same databases using the same terms listed above and the phrase *adults with dyslexia* to find additional research studies. We also searched using the phrase *college students with learning disabilities* and the terms *postsecondary education, dyslexia, instruction, intervention, treatment, instructional methods, teaching methods, direct instruction, explicit instruction, strategy, small-group instruction, large-group instruction*, and *writing.* We searched using the phrase *high school literacy* and the terms *reading, math, spelling, language arts, decoding, reading comprehension, fluency, word, vocabulary, learning disabilities, dyslexia, teaching methods, instruction, instructional effectiveness,* and *writing*. Results from all the searches were merged into one file, and duplicate citations were eliminated.

Finally, a hand search of the following journals from 1990 to the present was conducted to locate any articles that might not have emerged from the computer search: *Journal of Learning Disabilities, Journal of Educational Psychology, Learning Disability Quarterly, Reading and Writing, Learning Disabilities Research & Practice, Exceptional Children, Journal of Special Education, Remedial and Special Education, Reading Research Quarterly, Scientific Studies of Reading, Annals of Dyslexia,* and *Applied Psycholinguistics.*

Due to the limited number of research articles found in the *adults with learning disabilities* search

described above, our search was expanded to include *adolescents with learning disabilities.* The same search terms described above were used for the adolescents with LD search.

INCLUSION AND EXCLUSION CRITERIA

Any qualitative, quantitative, or empirical research study was included in this synthesis if it met both of the following criteria: (a) it pertained to either adults or adolescents with learning disabilities, and (b) it pertained to instructional methods for reading, writing, spelling, vocabulary, math, science, or social studies. For the purpose of this synthesis, "adults" were defined as individuals over the age of 16 who were no longer enrolled in K–12 education. "Adolescents" were defined as individuals over the age of 14 who were still enrolled in K–12 education. Thus, our review of the literature included "older adolescents" and excluded "younger adolescents" attending upper elementary and middle school. This decision was based on the developmental difference between these groups and the skill changes that typically occur. For example, Catts, Hogan, and Adlof (2005) found that the amount of variance predicting reading comprehension varied developmentally. Specifically, the impact on reading comprehension of word-level skills shifted dramatically when second and fourth graders became eighth graders. By the eighth grade, word-level skills such as phonics and decoding accounted for less of the variance in predicting comprehension than they did in the earlier grades. For the students in eighth grade, vocabulary predicted more of the variance than did word-level skills for the students with reading disabilities in the study. Thus, instructional content that may be appropriate for second and fourth graders may not meet the needs of students in the eighth grade. As learner development, learning context, and academic expectations change, caution must be used when identifying effective practices from the research literature on younger learners that might impact the learning of adults, college students, and even older adolescents with LD.

Several articles and reports were excluded from the review. Briefings, position papers, evaluative reports, or general "think pieces" were excluded. In addition, research studies that dealt with instruction in foreign languages, social skills, self-advocacy, and career development skills were excluded.

View of the Research

The search resulted in the identification of an initial pool of 220 articles and dissertations. A total of 190 articles focused on adolescents with LD, and those articles were pulled from the primary analysis. Articles that were "think" pieces or dealt with characteristics of adults with LD numbered 30. These articles were not included in the review.

The 19 empirically-based articles included studies conducted with adults with LD or reading disability, and they were coded as either being experimental (n = 4), quasi-experimental (n = 6), single subject (n = 5), or qualitative (n = 4). The selected articles were then classified as studies of college students with learning disabilities, adults with LD, or studies that included some combination of adults, adolescents, and/or younger adolescents. Finally, studies were further divided into categories for reading, math, or multiple content area studies such as reading, English, and math; Web-based or technology instruction; transition, cognitive, and direct instruction; or writing (see table 1).

This review of the literature made evident the strengths and weaknesses in the research base.

After repeated calls for additional and rigorous research with adults with LD and increased efforts to support such research by National Institute of Child Health and Human Development, Office of Vocational and Adult Education, and National Institute for Literacy, the extant body of research remains limited in scope. Additionally, several content areas remain largely ignored by researchers and funding agencies alike. For example, the limited number of studies found in writing and math makes it difficult to draw strong conclusions about what works instructionally in these areas.

Report of the Findings

WHAT EVIDENCE-BASED INTERVENTIONS AND PRACTICES ARE AVAILABLE TO PRACTITIONERS WHO WORK WITH ADULTS WITH LD?

In this section, the research supporting instruction and instructional arrangements is discussed. Specifically, the effects of direct instruction or explicit instructional models, the cognitive and metacognitive self-regulatory behaviors associated with explicit instruction models, and the uses of instructional technology are reviewed. In addition, the issue of place is reviewed. That is, "In what environment are adults with LD best taught the critical content, skills, and strategies that support increased literacy performance?" The literature review resulted in the identification of several research studies that focused on the effects of specific instructional methods with adults with LD (see table 1).

EXPLICIT INSTRUCTION

Researchers examined the effects of strategic learning, guided reading, metacognitive training through thinking aloud protocols, self-regulation, and explicit strategy instruction. One study examined the feasibility of implementing explicit instruction in typical adult basic education centers. Results of these studies are summarized below.

Explicit instruction: Math. In a study of the effects of explicit instruction on the math word-solving-abilities of community college students with LD, researchers found that explicit instruction in translating compare-type word problems, supplemented with visual diagramming for schema, resulted in significant gains in student ability to solve math word problems (Zawaiza & Gerber, 1993). In this study, students were taught math problem-solving skills using different methods. In the attention-control condition, students were given word problems and participated in informal discussions in a math class about solving the word problems. In another condition called translation, they were explicitly taught a process for solving word problems. Explicit instruction involved clear statements of process, modeling target behaviors, guided practice, independent practice, corrective feedback, and post-testing. In a third condition, students were taught using the translation methods described above with the addition of a diagramming schema component. In the diagramming component condition, students were taught how to diagram relationships between the key ideas found in word problems and how to create equations.

Six intact classrooms with 38 college students with LD were randomly assigned to one of the three conditions. Students in the translation-plus-diagramming condition outperformed students in the translation-only and attention-control conditions on measures of math word problem–solving strategies and process knowledge. Researchers found that post-test reversal-error

performance was significantly higher for the translation-with-diagramming group than the other conditions. Reversal errors are errors in which the student does the inverse of what is required to solve comparison-type word problems.

Thus, according to the authors, effective instruction should include problem-solving strategies integrated with schema training in order to help students improve their understanding of word problem content, and the important factors that should be taken into consideration when solving such problems (Zawaiza & Gerber, 1993). Schema training, as made operational in this study, involved direct training in recognizing, identifying, and labeling word problem "types" that helps students develop accurate representations of critical problem elements in memory. No math skill or math strategy outcome measure data were reported.

Explicit instruction: Reading. Focusing attention on word recognition reading component skills and direct explanation, Massengill (2003) studied the impact of guided reading on the reading performance of four low-literate adults. Guided reading is a direct instruction process in which the instructor models expert readers' behaviors and scaffolds support for both cognitive and metacognitive instruction. Guided reading combines elements of text selection, strategy development, and scaffolded support to improve reading outcomes.

The Massengill study (2003) targeted instruction in multiple word recognition skills and strategies embedded within a guided reading model. A single-subject design was used to test the effectiveness of the intervention. Standardized measures were used to assess growth (Slosson Oral Reading Test-R, Slosson & Nicholson 1990; Analytical Reading Inventory, Woods & Moe, 2006; Woodcock Reading Mastery Test Word Attack Test Subtest, Woodcock, 1998). Results of the study showed that the word-level skills of the adults in the study improved significantly as measured by standard reading tests after instruction utilizing guided reading. Overall global reading level was increased for all four learners in the study, with grade-level scores increasing from 1.4 grade equivalents to 3.1 grade equivalents during 32 hours of instruction. These gains are impressive, given the initial low reading-level scores of the participants. In sum, low-literate adults benefited from instruction in word recognition skills using a guided reading framework. These results are limited, in part, by the small number of participants in the study and the fact that the participants were identified as low-literate adults. The participants were described as very poor, disheartened readers (i.e., reading at the first-through sixth-grade levels).

In an experimental study with 90 adult poor readers randomly assigned to one of three experimental conditions or one of two control conditions, Rich and Shepherd (1993) investigated the effects of a modified reciprocal teaching reading intervention (Palincsar & Brown, 1984). Poor readers in an adult basic education center were taught two reading comprehension strategies (self-questioning and summarizing), either singularly or in combination. Control students were given materials and tests or just tests over reading material. Results showed that the reciprocal teaching condition participants scored significantly higher on measures of reading comprehension. Thus, a proven reading comprehension intervention for children and adolescents was found to be effective for adult poor readers attending an adult basic education center. While many poor readers do have LD, this study did not identify whether any readers in the study had LD. Thus, extending the findings of this study to adults with LD should be done with caution.

Explicit instruction: Content. Strategy instruction has been linked to effective instruction for adolescents with LD, and there is some evidence to support the idea that adults with LD benefit from the same type of strategy instruction. For example, Allsopp, Minskoff, and Bolt (2005) evaluated the effects of a 3-year demonstration project that involved the devel-

opment and field testing of a course-specific strategy instruction model. In this study, 46 adult college students with LD were provided one-to-one semester-long instruction by graduate student tutors. Tutors used explicit instruction to teach the students various strategies that were context based and responded to the immediate needs of the students. A strategy curriculum appropriate for the demands of the courses students were enrolled in and that reflected research on strategy instruction was developed. Then, students and tutors selected and prioritized the strategies that would be learned and applied during tutoring sessions. The instructional approach involved having the tutors follow an explicit instruction model while teaching the selected strategies during their tutoring sessions. This instruction was in contrast to previous tutoring that was based upon assignment completion sessions. The primary quantitative outcome measure was student grade-point average. While the study was described as a quasi-experimental study, no comparison group data were obtained (i.e., no such group existed) on the GPA outcome measure. Students' overall GPA improved significantly over pre-intervention GPA scores, and students maintained the GPA advantage after tutoring support ended. In addition, large effects (Choen's *d* value of 1.01) were obtained for student GPA in the tutored course when GPA in the content course was compared to GPA in the same content area with instructional tutoring support. Given that no comparison group data are reported, causal factors related to the primary outcome variable are difficult to identify and the results must be interpreted cautiously.

Explicit Instruction: Metacognition and self-regulation. Butler (1995) investigated the effectiveness of self-regulation and strategic learning instruction on the performance of adults with LD in postsecondary education programs. The intervention was designed to teach students how to be strategic in their learning rather than follow a set of specific cognitive strategies (Butler, 1995). For example, students were taught how to create or coconstruct strategies specific to the academic tasks they faced. As a first step in this process, students were exposed to examples of how strategies were used in context before they received direct explanation instruction. This model was, in effect, individualized and targeted tutoring in cognitive and metacognitive learning. Results of the multiple baseline data analysis showed that student performance improved significantly in writing, as did metacognitive knowledge about the writing tasks they faced. Importantly, measures of engagement indicated that students were actively engaged in their learning, and better able to attack noninstructed tasks strategically.

A single-subject pre-/post-design was used to measure the effectiveness of the intervention with baseline and postintervention scores graphed. While the wide generalizability of the results is not supported by the findings of this study, supporting students as they coconstruct strategies that address specific and authentic needs seems to be a promising practice.

The instructional arrangement used in this study was a one-to-one, intense, and explicit instructional tutoring model. The one-to-one model may be a limiting factor in implementation on a wider scale (Butler, 1995).

In another article (Butler, 2003), a review of seven studies of the strategic content learning (SCL) model, conducted with adults and adolescents with LD, was discussed. The stated goal of SCL is to support students in the development of self-regulation and metacognitive behaviors that support learning content, and to move from direct instruction in which already created strategies are taught. The SCL model is designed to place more emphasis on coconstructing strategies than teaching previously created strategies that are more generic and, therefore, less contextualized. Coconstructed strategies are the result of a process in which the teacher and learner respond to context-based task demands and create a strategy together that addresses the task at hand. In these studies, students were taught how to construct

strategies that addressed immediate academic needs, and involved the use of cognitive and metacognitive strategies. Researchers found that students could learn to construct strategies that addressed tasks, increase their metacognitive knowledge about tasks, monitor their learning success, and become actively involved in strategy development and generalization in comparison to students who did not participate in the SCL instruction. Theses differences were statistically significant at the .05 level. However, measures of improved literacy outcomes in areas such as reading, writing, or math were not obtained. Thus, the effects of SCL on literacy outcomes are unknown.

Kucan and Beck (1997) conducted a review of the research supporting thinking aloud as a method of reading comprehension instruction. As an instructional model, teachers employ thinking aloud as they model their thinking procedures as they read text. Students are eventually involved in the thinking-aloud protocol as they read and think aloud about what and how they read. Textual meaning is constructed through collaborative class discussion. While there are variations of thinking aloud, the procedure is widely used and embedded in multiple models of cognitive and metacognitive strategy instruction. For example, reciprocal teaching (Palincsar & Brown, 1984), transactional strategy instruction (Pressley, 1992), and questioning the author (Beck & McKeown, 2006) all use think aloud as a key instructional component designed to engage students in the interpretation and construction of meaning when reading authentic text.

Think aloud has been examined as an intervention for adult struggling readers by Berne (2004). In an analysis of the effects of using think-aloud protocols with community college students, the author questions the practice as an instructional method in terms of improved comprehension monitoring and reading proficiency. Think aloud is designed to improve metacognitive and cognitive learning through student engagement in tasks that are structured and supported by an expert reader model. In an intact class pre-/post-test pilot study, Berne taught students how to use think aloud to monitor their comprehension of text. However, students in this study struggled with understanding the difficult text they were reading using think aloud. The lack of basic skills seemed to prevent students from fully embracing and using think aloud to improve comprehension. Also, their history of reading failure may have inhibited their willingness to participate in reading and think-aloud activities. Thus, while widely used with children and adolescents, use of think aloud with adults may be dependent upon the initial reading skill level of the students and their willingness to publicly read and think aloud.

ADDITIONAL SKILL AND STRATEGY INSTRUCTION

Writing skills and strategies. In a study designed to measure the effects of explicit instruction on learning proofreading for spelling accuracy intervention, McNaughton, Hughes, and Clark (1997) found that, overall, spelling accuracy improved but not enough to enable the students with LD to reduce spelling errors to a level equal to their non-LD peers. Only one of five conditions resulted in significant student performance gains in spelling. Specifically, students who were explicitly taught to use word processing with embedded spell-check statistically outperformed students who (1) wrote by hand with no additional support; (2) wrote by hand and used a print dictionary; (3) wrote by hand and used a handheld spell-checker; or (4) used word processing with no spell-checker. Thus, in terms of proofreading for spelling errors, students were more efficient in correcting spelling errors and preferred the word processing with spell-check condition over the other treatments. While participants' spelling skills did not improve to a point where they spelled as proficiently as their non-LD peers, they were able to produce improved writing products with fewer spelling mistakes, thus supporting improvement in overall writing skills. In chapter

4, research-based assistive technology solutions to the challenges faced by adults with LD are discussed. The reader may find this information helpful in terms of additional support for writing skills instruction for adults with LD.

Note-taking strategies. In a study designed to measure the effects of a note-taking strategy on the ability of college students with LD to improve their lecture note-taking skills, researchers found that a pause-and-reflect procedure significantly improved students' ability to take and remember lecture notes (Ruhl, Hughes, & Gajar, 1995). In a quasi-experimental design, students with LD and students without LD were presented lectures in which a video lecture was paused for 2 minutes at logical points. Students then discussed the lecture in dyads and answered questions about vocabulary and concepts.

The pause procedure significantly improved student performance on measures of immediate recall of content and performance on short-term content knowledge tests. However, the procedure did not improve long-term recall as measured by researcher-developed tests of lecture content. Whether pausing the lecture or involving students in peer discussion groups enhanced the performance of both groups was not discussed. However, pausing lectures and providing students with the opportunity to think about and discuss the lecture with peers seems like a promising practice that both engages students in the lecture process, and supports clarification of knowledge.

In a follow-up study, Ruhl and Suritsky (1990) tested whether the addition of a lecture outline in addition to the pause procedure would produce even greater gains. Researchers found that the pause procedure alone had more benefit alone than the pause-and-outline condition for the immediate recall of facts. The pause procedure alone was also more beneficial than the other conditions when completeness of notes was measured. Researchers concluded that the outline may have acted as a distraction during note taking. However, the follow-up study did provide converging evidence that explicit instruction and the pause procedure is an effective practice for taking notes by college students with LD.

Technology-based interventions. Research on the use of technology to support instruction for adults with LD is an emerging field. Several studies have been conducted to measure the impact of technology-based interventions, including using websites as motivating factors, assistive technology such as text-to-speech, use of speech recognition software, videodisc-based instruction for teaching algebra, and multisensory presentation of print (e.g., Coiro, 2003; Johnson & Hegarty, 2003; Kitz & Thorpe, 1995; Leu, 2002; Silver-Pacuilla, 2006). One of the most recent innovations in technology-supported instruction is "new literacies." New literacies includes the skills, strategies, and self-regulation required to read, write, and learn using Internet technologies and information that prepare students to communicate in a rapidly changing world (Leu, 2002). The research supporting these technology-based instructional supports is discussed below.

In a technology-based intervention study, Johnson and Hegarty (2003) interviewed and observed adults with LD use the World Wide Web to find and use information. In this qualitative study, student motivation for using the Web was assessed, and students were observed as they navigated the Web and accessed text on multiple websites. According to the authors, measures of motivation showed that students liked working on the Web and put forth effort to learn in that environment. Further, observations of the students as they attempted to utilize the resources of the Web indicated that they were frustrated in finding information and unskilled in the skills and strategies needed to obtain information. The authors suggest that adults with disabilities need instruction in strategies for reading Web site text and in navigation within sites. Thus, while the Web was seen as a motivating learning tool, adults with LD seem unprepared to take advantage of learning in this environment (Johnson & Hegarty, 2003).

Silver-Pacuilla (2006) also found technology to engage adult learners with LD attending adult basic education programs. This project explored the efficacy of supported access to assistive technology to improve the literacy skills of adults with LD. The program was a supplement to regular adult education course work. Silver-Pacuilla studied whether students increased their engagement in learning when using multisensory print through text-to-speech and speech recognition software and whether this had impact on literacy skills. Ten students participated in the study. An exploratory research design was used involving case studies, reflective conversation, and focus groups. This mixed-design model was utilized to analyze the impact of technology on the motivation of adults with LD to access information. The author stated that students felt that assistive technology could make self-study more effective and rewarding, more so than they had experienced in the past. The students felt that they were more engaged in learning, more organized, and better able to engage in self-study with the use of technology.

Kitz and Thorpe (1995) studied the effectiveness of a videodisc program designed to teach algebra to college students with LD. The videodisc intervention was built with the principle of direct instruction embedded in the program. Direct instruction in this case included mastery learning of skills and components, quizzes and feedback, and extensive review, all embedded within a highly structured curriculum. Students in the videodisc condition were compared to students in a traditional instructor-taught algebra class. Specific units in algebra were taught in both conditions. Students in the videodisc condition significantly outperformed comparison-group students on measures of lesson content. In addition, the videodisc group earned significantly higher grades in the college algebra course and on two measures of algebra skills and knowledge. There were significant differences on measures of algebra skills and on course grades in favor of the videodisc condition. The results of this study show promise for technology-based interventions to engage students in learning and improve basic math skill performance through extensive practice and feedback.

The ever-increasing use of technology to access information is changing the way we think about instruction for adults with learning disabilities. Research in this area may help the field improve the literacy support provided to adults with LD. Further, the findings of Johnson & Hegarty (2003) indicate that adults with LD will need to learn new ways to process the abundance of information they encounter in an online environment to take full advantage of the motivating factors associated with learning on the Web.

An emerging knowledge base in what Leu and colleagues at the University of Connecticut have termed "new literacies" (Leu, 2002) is challenging our assumptions about the strategies needed to support comprehension of online information. New literacy research is underpinned by the belief that reading comprehension in an online environment involves different processes than text-based reading. While there may be clear links to text-based comprehension strategies like questioning, summarizing, making inferences, and clarifying, these strategies may require different thought processes when reading in an online environment (Coiro, 2003). Further, the Internet provides opportunities for interacting with new text formats like hypertext and interactive multiple media, and the reader may have different motivations and purposes for reading in an online environment. These factors may change the way the reader approaches the reading task. While the findings from experimental research studies evaluating the efficacy of interventions designed to improve online comprehension have yet to be reported, practitioners who work with adults with LD should be aware of the implications for instruction of the shifting literacy demands of a new literacy environment. Those who work with adults with LD should explore the use of

technology-based interventions, as they seem to hold promise for improving the literacy levels of adults with LD (Bethell & Miller, 1998; Engstrom, 2005; Johnson & Hegarty, 2003; Silver-Pacuilla, 2006).

Explicit instruction: Feasibility. If explicit instruction is effective with adults with LD, as research seems to indicate, a question remains as to whether adult education (AE) instructors can and will use explicit instruction with their adult students. To answer that question, Mellard and Scanlon (2006) investigated the feasibility of using explicit instruction with adults with LD. In the study, the authors compared the instruction in adult education centers using ecobehavioral assessment with four AE instructors' classrooms. Ecobehavioral assessment is an observational method of classifying behaviors of target subjects in which observers code student and instructor behavior. The Mainstream Special Education Version of the Code for Instructional Structure and Student Academic Response (MS-CISSAR) instrument (Carta, Greenwood, Schulte, Arreaga-Mayer, & Terry, 1988) was modified to assess instructor and learner behaviors.

The researchers found that instructors could learn and would use an instructional model that was vastly different from what typically occurs in AE classrooms. Teachers engaged students in more discussion about ways to learn information, and spent significantly more time in academic and think-aloud talk as opposed to what typically happens in AE classes. Typical instruction in this study was found to be one-to-one tutoring help (92% of the time), with little small- or large-group instruction in which instructors took the lead and provided explicit instruction. The authors concluded that explicit instruction with a metacognitive focus was a viable format for instruction in AE classrooms, and that students obtained significantly more instruction in those classrooms. This initial pilot study shows that explicit instruction is a promising and feasible practice in AE classrooms.

Currently, research efforts sponsored by the National Institute for Childhood Health and Diseases (NICHD) and Office of Vocational and Adult Education (OVAE) are under way for adults in basic education and GED programs. These rigorous experimental studies involve studying the effects of explicit instruction models on the literacy performance of adults in basic education and GED programs. The participants in these studies include adults with LD. While results are yet to be fully analyzed and published, this national research effort should do much to inform the field as to what instructional methods and content are effective for adults in adult basic education and GED centers. For more information about these studies, see http://www.nifl.gov/nifl/press_releases/02_10_pr.html and http://www.ed.gov/about/offices/list/ovae/pi/AdultEd/readingabs.html.

How can we best deliver instruction to adults with LD? Currently, most evidence supports intensive instruction as a defining feature that characterizes the service-delivery model most effective for adults with LD. Intensive means instruction that is delivered in a one-to-one or small-group format. Evidence supports the notion that instruction delivered in this manner and that is pedagogically explicit is the most effective way to produce significant literacy skill gains (Allsopp, Minskoff, & Bolt, 2005; Butler, 2003; Hock, 1998; Kitz & Thorpe, 1995; Massengill, 2003; Zawaiza & Gerber, 1993).

Of all the services provided to college students with LD, some form of tutoring is the service most often provided (Bigaj, Shaw, Cullen, McGuire, & Yost, 1995; Keim, Whirter, & Bernstein, 1996; Mohr, 1991; Vogel, Hruby, & Adelman, 1993; Zaritsky, 1989). The usual outcome of this service is immediate success. However, learners can become dependent on tutors for success (Brinckerhoff, Shaw, & McGuire, 1993).

Tutoring models that can incorporate what we know about explicit instruction can be positive in terms of student independence and academic success. For example, the strategic tutoring model (Hock, Deshler, & Schumaker, 2000) requires that

the tutor follow a four-phase instructional sequence when a student needs assistance with an academic task. In Phase 1, the tutor assesses the student's current approach to the task by asking questions to determine the nature of the strategies the student currently uses. Once the tutor has clarified the assignment and helped the student identify strategies the student currently uses, he or she discusses the rationale for learning a more effective strategy. Then, the tutor asks the student to commit time and effort to learn a more effective strategy. In Phase 2, the tutor coconstructs with the student a learning strategy that addresses the student's immediate academic need. The tutor carefully explains each step of the strategy and checks to make sure that the student understands each step. In Phase 3, the tutor models the strategy for the student by thinking and problem solving aloud on a task similar to the student's current assignment. The tutor also checks the student's understanding of how to use the strategy by guiding the student through application of the strategy to the student's current assignment. Eventually, the tutor guides the student through application of the strategy to current assignments and provides positive and corrective feedback, gradually helping the student to become independent in strategy application. Finally, in Phase 4, the tutor discusses and plans with the student ways the student can independently transfer the newly acquired strategy to future and similar academic tasks.

In a study of the effects of strategic tutoring (Hock, 1998), 28 academically at-risk first-year university students, including two students with LD and one with ADHD, were assigned to strategic tutors and received weekly subject-area tutoring in English Composition 101. The mean American College Test (ACT) composite score for this group was 17.74. The reading comprehension percentile mean score was 36 as measured by the Stanford Diagnostic Reading Test (Karlsen & Gardner, 1995). A comparison group of 28 higher-achieving students was chosen as a contrast condition. The comparison students had scores on all measures that were significantly higher than students in the strategic tutoring condition. For example, the comparison group's mean ACT score was 23.39.

Students in the experimental group met with their strategic tutors for approximately 3 hours a week for 3.5 months for English Composition 101 support. During these tutoring sessions, students and tutors worked on preparing for or completing actual theme-writing assignments. Tutors imbedded theme-writing strategy instruction while they provided support for current assignments. Students in the comparison group worked individually on their English Composition 101 assignments but had access to other university tutors.

Students in the experimental condition reported that they learned strategies that tutors reported teaching to them, and they also reported learning a relatively high percentage of steps related to those strategies (79%). Additionally, results indicate that underprepared college students, including college students with LD, can be taught a writing strategy by means of instructional tutoring and can generalize that strategy to a challenging college course. Six of the students who participated in the study were students with LD or ADHD. The findings of the study indicated that these students can learn the strategies reported as taught to them by their tutors and earn grades comparable to those of their nondisabled peers in challenging courses (Hock, 1998).

FOUNDATIONAL RESEARCH WITH ADOLESCENTS WITH LD

What foundational research-based instructional practices have been found to be effective with adolescents with LD? A considerably larger body of intervention research exists for adolescents with LD. For the purpose of this review, we will highlight the findings of literature reviews, synthesis of research, and results of meta-analyses conducted on adolescents with LD (Gersten, Fuchs, Williams, & Baker, 2001; Swanson, 1999; Swanson & Hoskyn, 1998;

Swanson & Sachese-Lee, 2001; Torgesen, 2005; Vaughn, Gersten, & Chard, 2000). While transferring the results of adolescents with LD intervention studies to the population of adults with LD must be done with caution, the findings may help inform instruction for the adult population. Those instructional practices are highlighted next.

Teaching content. Teaching content to adolescents with LD has been the focus of much of the work conducted at the University of Kansas Center for Research on Learning (KU-CRL). A line of work called content enhancement (CE) has been developed and tested at the KU-CRL. Content enhancement is composed of planning and teaching routines. These routines include ways to select and plan for content instruction, and ways to explicitly teach content to diverse groups of students (Lenz, Deshler, & Kissam, 2004). Students with disabilities often struggle with learning content when it is presented in a lecture-only format. They benefit from content instruction that translates content into easy-to-understand formats supported by visual diagrams or graphic-organizer devices delivered with explicit instruction. Graphic organizers have been found to be effective in helping adolescents who struggle with learning acquire critical content necessary for improved knowledge of the world (see Hall & Strangman, 2002, for a review of the research supporting the use of graphic organizers). CE teaching routines have been validated with adolescents with LD in secondary school settings (Bulgren & Lenz, 1996; Deshler et al., 2001; Lenz & Bulgren, 1995). Findings from these studies show that critical content can be taught to students in classes characterized by diversity. One of the key outcomes of explicit instruction using CE has been the significant growth of content knowledge by all students in the classes, including students with learning disabilities (Bulgren, Deshler, & Schumaker, 1997; Bulgren, Lenz, Schumaker, Deshler, & Marquis, 2002; Bulgren, Schumaker, & Deshler, 1994). Growth in content knowledge is critical if adults with LD are to meet the requirements of GED exams, which place heavy demands on knowledge of content. Thus, teaching them content through the use of content enhancement routines is a practice that may help adults with LD meet the requirements of the GED.

Studies in this line of research have focused primarily on instruction in middle and high school subject-matter classrooms that contain students of diverse abilities, including students with LD (Bulgren & Lenz, 1996; Lenz, Bulgren, & Hudson, 1990; Schumaker, Deshler, Bulgren, Davis, Lenz, & Grossen. 2005; Schumaker, Deshler, & McKnight, 2002). Overall, the main goal of this research has been to determine the effectiveness of a series of instructional routines designed to enhance the content acquisition of all students in general education classes, including students with LD.

Recent studies provide data to support CE routines. For example, Bulgren, Deshler, Schumaker, and Lenz (2000) extended the research in a study (using random assignment of classes) to conceptual learning through analogies. They found that students who participated in the experimental condition of the concept anchoring routine (Bulgren et al., 1994) earned significantly higher scores than students in the control condition. This routine also supports content area instruction that builds on prior knowledge, vocabulary, and summarization.

Bulgren et al. (2002) explored the use of a comparison routine in secondary content classes and found significant differences between the experimental and control groups. In the concept comparison routine, targeted concepts are compared and contrasted through classroom discussion supported by visual devices. Of particular interest in this study is the fact that an effect size (partial eta square) of .375 was found for low achievers. Using partial eta square (Cohen, 1988), an effect size above .1379 is considered large. This study provides support for use of the CE routines to help students manipulate relationships among content area concepts.

Similarly, results of a study involving the question exploration routine (Bulgren, Lenz, Deshler, & Schumaker, 2001) indicated that students who learned content information through this routine scored significantly better on tests designed to assess knowledge, application, and generalization of information than students who were taught the same information in a traditional lecture-discussion format (Bulgren, Lenz, Schumaker, Deshler, & Marquis, 2004a). The partial eta square effect size for this study was .352. Results of another study using the questioning routine conducted in randomly assigned classrooms indicated that when teachers used the routine to teach a regularly scheduled language arts unit, students performed better on classroom tests when the routine was used than did those instructed in a traditional lecture-discussion format (Bulgren, Lenz, Schumaker, Deshler, & Marquis, 2004b). The partial eta square effect size for this study was .273. These studies support not only learning content, but also provide support for instructing students how to generate inferences from expository text.

Data have been analyzed to validate the power of the routines described above. For example, for the question exploration routine, effect sizes were computed from results of one study to determine their effectiveness in experimentally controlled conditions utilizing random assignment of students focusing on socioscientific issues (Bulgren et al., 2004a), and in another randomly assigned classroom study of teacher use of the same procedures in a language arts class (Bulgren et. al., 2004b). Effect sizes were measured by eta square, where .1397 or above are considered a large effect size (Cohen, 1988). Both studies resulted in large effect sizes of .225 and .325, respectively, for the entire class of students. Furthermore, significant differences in favor of the experimental condition were found for subgroups of students who were low achieving and learning disabled, as well as other groups of high and average achievers. This body of research on the effects of content enhancements shows some promise as foundational support for the use of CE routines with adults enrolled in GED, college, and technical school classes or other situations in which students are expected to learn content.

Teaching students strategies for literacy. Teaching students strategies for reading, writing, and remembering important information has been found to be effective for adolescents with LD (Gersten et al., 2001; Swanson, 1999; Swanson & Hoskyn, 1998; Swanson & Sachese-Lee, 2001; Vaughn et al., 2000). These strategies include the cognitive processes efficient readers employ when they read narrative and expository text, and the metacognitive and self-regulatory strategies they use when they select, monitor, and evaluate their understanding of text (Deshler & Schumaker, 1988; Gersten et al., 2001; Swanson, 1999; Swanson and Hoskyn, 1998; Torgesen et al., 2007; Vaughn et al., 2000). Thus, teaching strategies for learning how to learn may have merit for adults with LD.

Central to teaching content, skills, and strategies to adults and adolescents with LD is the explicit nature of the instruction. Explicit instruction is characterized by its inclusion of clear explanation of specific skills and strategies supported by expert models of the skills or strategies being applied in the context of tasks familiar to students. In addition, extensive practice of skills and strategies in context with scaffolded support has been found to be effective in guided, partner, and independent structures (Swanson and Hoskyn, 1998; Torgesen, 2005). Additionally, practice is greatly enhanced when students are provided with positive, corrective, elaborated feedback (Kline, Schumaker & Deshler, 1992). Thus, the use of explicit instruction with adults with LD may be considered a promising practice.

Writing. The effectiveness of teaching adolescent writers with LD writing strategies to enhance their writing competencies is well documented in the literature (e.g., Graham & Harris, 2003; Graham & Perin, 2007b; Hallenbeck, 1996). Recently, this body

of research has been bolstered by a meta-analysis conducted by Graham and Perin (2007a). In this analysis of multiple research studies conducted with adolescents, the authors found that teaching adolescents strategies for writing, summarizing information, using peers to provide feedback on writing products, and setting goals for writing all produced high effect sizes. While this body of research was conducted with adolescents at various levels of learning proficiency, many of the participants were adolescents identified as special needs learners (SNL). Thus, the findings in this study can be applied to writing instruction with adults with LD, although with some caution.

In sum, research conducted with adolescents with LD holds promise for adults with LD when the focus of instruction is on teaching important content, teaching reading and writing skills and strategies, and in using explicit instruction. Instruction that is explicit in nature and strategies that address authentic learning tasks are practices that should be used with adults with LD.

Discussion, Conclusions, and Recommendations

This chapter began with the goal of answering several key questions. The first question was, "What evidence-based interventions and practices are available to practitioners who work with adults with LD?" The second question was, "How can we best deliver instruction to adults with LD?" Finally, and in order to supplement the limited database on adults with LD, we asked, "What research-based instructional practices have been found to be effective with adolescents with LD that hold promise for adults with LD?" Our review of the literature on what works with adults with LD, supplemented by highlights from the literature on what works with adolescents with LD, has helped us to begin to frame answers to those questions. However, as this review has shown, there is much research that remains to be done.

While rigorous research on what works and under what conditions for adults with LD continues to be limited, evidence does exist to support several practices. That evidence is highlighted below.

1. *Explicit instruction* continues to be a practice supported by research. Adults with LD who struggle with learning respond positively to this instructional approach. Teachers can improve student learning of skills, strategies, and content by (a) providing clear explanations of content, skills, learning routines, and strategies, (b) modeling the cognitive and metacognitive behaviors associated with learning, (c) coconstructing with students the strategies and routines that make learning more efficient and effective, (d) engaging students in extensive practice that includes both guided and independent activities and elaborated feedback on each performance, and (e) providing support for planning both proximal and distal generalization of skills, knowledge, and strategies for learning.

Additionally, explicit instruction that encourages student engagement and conversations about strategy usage by balancing explicit instruction with coconstruction and student engagement in the process seems to enhance learning. As instructional practices for students with LD continue to evolve, practices in which students share in the construction of strategies and knowledge that address specific demands and contexts seem worthy of consideration (Rapp, van den Broek, McMaster, Kendeou, & Espin, 2007).

2. Explicit instruction has been found to be effective in teaching adults with LD a variety of skills, strategies, and content. For example, studies have found explicit instruction to be an effective or promising practice for math, reading, learning content, writing,

note taking, and in regulating metacognitive behaviors. Importantly, explicit instruction has been found to be a feasible instructional for use by teachers in adult learning centers.

3. Instructional arrangements that support intensive instruction have been found to be effective with adults with LD. The population of adults with LD has shown that instruction must be targeted and powerful and delivered in a manner that allows learners to practice extensively and receive elaborated feedback on their practice attempts. Elaborated feedback is feedback that is individualized (given to one person at a time), immediate (as soon after the performance as possible), positive (at least two positive statements are made about the performance), and corrective (specific feedback on an aspect of the performance that needs to be corrected is given) (Kline, Schumaker, & Deshler, 1991). One-to-one or small-group arrangements have been found to support intense instruction. However, more important than one-to-one or small-group delivery models is the type of instruction delivered in those arrangements. Poor instruction in one-to-one arrangements results in poor learner outcomes similar to the poor learner outcomes attained when poor instruction is delivered in larger groups.

One-to-one or small-group instruction that is intensive, engaging, and explicit in nature has been found to result in significantly larger gains than other types of less intensive or independent learning. Tutoring support can result in significant gains in literacy performance and skills, when strategies that are responsive to the current learning demands facing the students are taught explicitly. The effectiveness of tutoring support seems promising when explicit instruction is used to teach cognitive and metacognitive strategies, and when delivered in the context of current course work.

4. The use of instructional technology with adults with LD is a promising practice. The use of technology seems to be motivating to adults with LD, and they engage learning tasks more readily, at least initially. The technology interventions reviewed in the chapter, while helpful, indicate that adults with LD will require instruction in how to efficiently and effectively make use of technology to learn. Access to technology, while motivating, is not sufficient without related instruction in how to use these tools.

While there is much to learn about instruction with adults with LD, there are instructional practices and interventions that produce significant gains in learner outcomes. As a field, we should work toward the goal of delivering instruction to adults with LD that has a strong research base or in carefully evaluating interventions when no such research base exists.

A NOTE ON DESCRIBING PARTICIPANTS IN RESEARCH STUDIES

In 1992, and in response to the need to add clarity to research conducted with individuals with learning disabilities, the Council for Learning Disabilities updated guidelines that set standards for defining the term *learning disabilities* in reports and studies conducted with individuals with LD (Rosenberg, 1993). Those guidelines describe the individual characteristics that should be included when describing participants with LD in research studies. The review of the literature conducted in this chapter clearly shows that, as a field, we have yet to adopt those guidelines when reporting research conducted on those considered having LD (see table 1). With the exception of the Sitlington and Frank study (1990), none of the articles reviewed in the chapter followed the suggested guidelines. Researchers (and editors) should take care to fully describe or demand full descriptions of the participants in research studies so more informed judgments can be made in regard to what works, with whom, and under what conditions. Without this information, practitioners, policy makers, and administrators may not be able to make informed decisions about instruction and intervention.

Table 16:
Review of Intervention Literature for Adults With LD

Author/Study	Content	Participants	Number	Learner	Design
COLLEGE STUDIES					
Allsopp, D.H., Minskoff, E.H., & Bolt, L. (2005). *Individualized course-specific strategy instruction for college students with learning disabilities and ADHD.*	Math Reading	College	46	LD*** 57%	QE?
Berne, J. (2004). *Think-aloud protocol and adult learners.*	Reading	College	14	LD* SS	
Butler, D.L. (2003). *Structuring instruction to promote self-regulated learning by adolescents and adults with learning disabilities.*	Math Reading English	College	56	LD****	Q
Engstrom, E.U. (2005). *Reading, writing, and assistive technology: An integrated developmental curriculum for college students.*	Reading	College	8	LD* E	
Hock, M.F. (1998). *The effectiveness of an instructional tutoring model and tutor training on the academic performance of underprepared college student athletes.*	Writing	College	26	At-risk LD***	QE
Kitz, W.R., & Thorpe, H.W. (1995). *A comparison of the effectiveness of videodisc and traditional algebra instruction for college-age students with learning disabilities.*	Math	College	26	LD***	QE
McNaughton, D., Hughes, C., & Clark, K. (1997). *The effect of five proofreading conditions on the spelling performance of 12 college students with learning disabilities.*	Spelling	College	12	LD***	QE
Ruhl, K.L., Hughes, C.A., & Gajar, A.H. (1995). *Efficacy of the pause procedure for enhancing learning disabled and nondisabled college students' long- and short-term recall of facts presented through lecture.*	Note taking	College	30	LD****	QE
Ruhl, K.L., & Suritsky, S. (1990). *The pause procedure and/or an outline: Effect on immediate free recall and lecture notes taken by college students with learning disabilities.*	Note taking	College	30	LD****	E
Zawaiza, T.R.W., & Gerber, M.M. (1993). *Effects of explicit instruction on math word problem solving by community college students with learning disabilities.*	Math	College	60	LD**	E

Author/Study	Content	Participants	Number	Learner	Design
ADULT - POSTSECONDARY STUDIES					
Butler, D.L. (1995). *Promoting strategic learning by postsecondary students with learning disabilities.*	Math Reading English	Postsecondary (18—36 yrs)	6	LD****	SS
Butler, D.L. (2003). *Structuring instruction to promote self-regulated learning by adolescents and adults with learning disabilities.*	Math Reading English	Postsecondary & Secondary	70	LD****	SS
Johnson, R., & Hegarty, J.R. (2003). *Websites as educational motivators for adults with learning disability.*	Reading/ Web	Postsecondary (Adult)	8	LD[x]	Q
Massengill, D. (2003). *Guided reading—an instructional framework for adults.*	Reading	Postsecondary (Adult	4	LD*	SS
Massengill, D. (2004). *The impact of using guided reading to teach low-literate adults.*	Reading	Postsecondary (Adult	4	LD*	SS
Mellard, D., & Scanlon, D. (2006). *Feasibility of explicit instruction in adult basic education: Instructor learner interaction patterns.*	Instruction	Postsecondary (Adult	4	Teachers	QE
Rich, R., & Shepherd, M.J. (1993). *Teaching text comprehension strategies to adults who are poor readers.*	Reading	Postsecondary (Adult	90	Poor Readers	E
Silver-Pacuilla, H. (2006). *Access and benefits: Assistive technology in adult literacy.*	Reading	Postsecondary (Adult	10	LD	Q
Sitlington, P.L., & Frank, A.R. (1990). *Are adolescents with learning disabilities successfully crossing the bridge into adult life?*	Transition	Postsecondary (Adult	911	LD	Q

Notes: For eligibility criteria, LD = learning disability; ED = emotional disturbance. For design, E = experimental; LS = longitudinal study; Q = qualitative; QE = quasi-experimental; SS = single subject.

Learning Disabled Defined: The term *learning disabilities* was defined in multiple ways: √ Used criteria established by National Joint Committee on Learning Disabilities (1998); *Identified low-performing students with very low reading skills or adult struggling readers; ** "Met current state of California guidelines"; *** Used federal guidelines for LD and based on secondary school documentation (IEP/AR) presented to college office of disability services; **** Verified by psychological assessments—discrepancy formula IQ and achievement; ˣ Not described. p. 334

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Chapter 6
Transition and Adults with Learning Disabilities

Paul J. Gerber

Introduction

Transition is a process that cuts across two stages of development, adolescence and adulthood, as well as two distinct periods of life experiences, school and beyond school (Gerber, 1993). More important, movement through the transition process involves a culture shift that can be characterized from student to adult, from dependence to autonomy, and from supervision to self-determination. In practicality, the culture shift involves the K–12 school years, when the challenges of learning disabilities (LD) are generally recognized by school personnel and accommodated via individualized educational services and specialized teaching and learning techniques. However, when exiting school, the beyond-school culture is one where the concept of LD is confusing and imprecise to the average person (Roper Starch Worldwide, 1995). Thus, upon leaving school, it is important for an individual with LD to engage in a whole host of self-advocacy behaviors related to LD that help explain all aspects of their adult LD functioning, both generally and specifically (Field & Hoffman, 1994). In essence, adults with LD have to be truly adult—in control of their lives as independent, autonomous people, who have to speak for themselves (Gerber & Reiff, 1991).

Transition planning and preparation are driven by federal legislation, the Individuals with Disabilities Education Improvement Act (IDEIA) (2004), and its precursor, the Individuals with Disabilities Education Act (IDEA) (1997). The process of transition for students with LD begins during secondary school (mandated by law at age 16) prior to exiting their school-age programs at about age 18. Therefore, it is in the latter years that life beyond school becomes paramount in the thinking of school personnel who serve students with LD.

Individualized education programs (IEPs) and their transition component, the individual transition plan (ITP), stem from federal and state mandates to address a myriad of issues that are encountered in the adult years. They are tailored specifically to the beyond-school path of transition, dichotomized as school-to-work or school-to-school-to-work (Will, 1984). There are variations of that dichotomy, specifically when young adults with LD attend postsecondary education programs while working part-time and when unemployment interrupts job stability. The vast majority of individuals with LD go straight to work (approximately 86%), while the balance attend postsecondary programs within 5 years after leaving school (Wagner, 1993). Participation for the school-to-school-to-work route is about 16% (12% in two-year colleges and 4% in four-year colleges); however, that figure only represents attendance at some point, not program or degree completion, which is thought to be a lower percentage.

Transition for persons with LD has more than an employment or educational focus. The challenges for adults with LD are multifold. Bielinski, Thurlow, Calendar, and Bolt (1993) from the National Center

on Educational Outcomes first proffered their list of adult outcome areas for all adults. It included such items as (1) physical health, (2) independence and autonomy, (3) responsibility and participation in adult settings, (4) citizenship and contribution to one's community, (5) literacy and academic adjustment, and (6) quality of life satisfaction. Bassett, Polloway & Patton (1994) listed seven domains that were specific to the population of persons with LD: (1) education, (2) employment, (3) home and family, (4) community involvement, (5) recreation and leisure pursuits, (6) social/ interpersonal relationships, and (7) physical and emotional health. In summary, the outcome areas for adult LD functioning are generally similar to adults who are non–learning disabled—working in competitive employment, taking on familial roles (established and new), engaging in community participation (both civic and religious/spiritual), maintaining healthy interpersonal relationships, and pursuing interests through leisure and recreational interests.

The degree to which these adult outcome areas are successfully navigated underlies the quality of life of adults with LD far beyond their transition years. Moreover, the elusive standard of "successful transition" can be argued to be subjective at best. In a narrow view of transition, some individuals equate success with job entry and employment stability. When considering the adult domains of functioning referenced above, the concept of success becomes more complex and increasingly subjective.

For the 86% of individuals with LD who do not access postsecondary education and training upon initial exit from secondary school, formal assistance via the transition process is elusive once they exit high school—whether through the diploma or dropout route. In fact, they need not be considered LD if they do not want to self-disclose (Price, Gerber, Mulligan & Williams, 2005). Their school-age years, when they were labeled as LD, are behind them. Supports during transition are typically natural supports. There is little direct help for adults with LD, unless they attend adult basic education classes, receive literacy training, or participate in rehabilitation services. Self-help groups for adults with LD exist in some large metropolitan areas, but they vary in quality and their ability to provide adequate support.

As mentioned above, participation in adult education and literacy programs as part of a transition process—particularly in young adulthood—creates the opportunity to address the issue of LD in the adult years, if only on a time-limited basis. Whereas the focus is primarily educational, it seems impossible to ignore the broader issues of "the LD adult experience." The short-term goal will always be educational in nature, but a great deal of the teacher-student interaction is framed by the many facets of LD in adulthood. When adult educators have more context when teaching adults with LD, they will gain more understanding of their challenges, and the likelihood of productive outcomes will be greater.

A brief note: *Transition* has multiple meanings in the area of special education. It can describe the movement of special needs students from preschool special education classes to special or general education environments. It can also be interpreted as movement through the many phases of adult development (Erickson, 1968; Levenson, 1978). For the purpose of this review, the contours of the concept are framed above. It must be remembered that the starting point of the transition process for persons with LD has broad consensus; however, its end point has been less agreed upon for quite some time.

Literature Search

The research literature on transition and learning disabilities first focused on a search of all relevant databases. They included ERIC Clearinghouse, PsycINFO, Infotrac One, Academic One File, and Dissertation Abstracts International (DIA). In addition, searching by hand was done on the last 10 years of the following journals: *Journal of Learning Disabilities, Learning Disability Quarterly*, *LD Research and Practice*, *Remedial and Special Education*, and *Thalamus.* Only studies that were published in refereed journals were included, with two exceptions: (1) a chapter from a book by Paul Gerber, and (2) a paper that has been submitted for publication, which was presented at the American Educational Research Association meeting in 2008.

Also searched were websites pertaining to the broad area of learning disabilities and transition. These were the Center on Education and Training and Employment, International Dyslexia Association (IDA), LDOnline.org, Learning Disabilities Association of America (LDA), National Center for Learning Disabilities (NCLD), National Center on Secondary Education and Transition, National Center on Workforce and Disability/Adult, National Joint Committee on Learning Disabilities (NJCLD), National Longitudinal Transition Study 2 (NLTS2), SchwabLearning.org., and the U.S. Department of Education.

All searches were done on a disability-specific basis. Therefore, any work that was done under the categories of "mildly disabled" or "high-incidence disabilities" was excluded. The literature in research journals from the United Kingdom, where LD has a broader meaning, including such areas as developmental disabilities and mental retardation, was also excluded. Particular attention was given to work done in the post– Americans with Disabilities Act (ADA) era that began in 1990.

All research articles were vetted for inclusion via the standards set by the Council for Learning Disabilities Research Committee (1993). These guidelines were formulated for investigators to design and implement research studies in the field of learning disabilities. These guidelines are the accepted standard in the field for published articles in professional journals, particularly those that focus on research.

The search for literature in the area of transition and LD was driven by the primary question to guide the review of the evidence-based research: "What practices, procedures, and services can be implemented during the transition years that will foster positive outcomes in the beyond-school years for individuals with LD?" As can be seen in the search terms below, the issue of transition to higher education was excluded from this paper.

The following search terms were used for all searches:

1) transition and learning disabilities
2) transition and adults with learning disabilities
3) transition and dyslexia
4) transition and adults with dyslexia
5) transition preparation and learning disabilities
6) transition services and learning disabilities
7) adult basic education and learning disabilities
8) self-determination and learning disabilities
9) self-disclosure and learning disabilities
10) self-advocacy and learning disabilities
11) employment transition and learning disabilities
12) GED and learning disabilities
13) vocational rehabilitation and learning disabilities
14) Summary of Performance (SOP)

View of the Research

A substantial amount of writing has been done in the area of transition on a generic basis; however, less literature in this area has been produced with an LD-specific focus. Typically, the literature is presented as a "mildly disabled" or "high-incidence" category of which LD is one of the disabilities included. Therefore, the population targeted in this writing is generic by design, resulting in rather imprecise, nonspecific information lacking nuance for the population of persons with LD. The LD-specific literature can be characterized as being less substantive and lacking quality research. In fact, the vast majority of the literature addresses issues and proffers "best practices," which often are not data driven. Moreover, the writing is skewed toward practitioners and their practice. Typically, it does not provide guidance from research studies or systematic evaluation studies of recommended practices.

The research that was used for this review came in a variety of forms. Designs of the research cited were both quantitative and qualitative in nature. Qualitative work cited used standard scientific methods in the area of psychology and education as well as accepted scholarly procedures for case studies, ethnographies, surveys, and questionnaires. Research reviews and meta-analyses were used when judged appropriate. As previously mentioned, the area of transition is less written about on a disability-specific basis. Therefore, at times, it was useful to refer to policy statements pertaining to LD from federal agencies, professional associations and societies, and public and private vetted Web sites.

Transition: Report of Findings

EXIT DATA ON STUDENTS WITH LEARNING DISABILITIES

Data on graduation rates for students with LD in reporting year 1995–1996 showed 58.6% graduating with a standard diploma, with the balance (41.4 %) dropping out of school. The graduation rate increase in reporting year 1999–2000 revealed 62.1% of students with LD graduated with a standard diploma, with 37.9% dropping out of school. Wagner, Newman, Camento, Levine, and Garza (2006) in the NLTS2 study aggregated LD and ADD to report that 75% of out-of-school students had completed a high school diploma "almost all with a regular diploma." Possibly, this positive trend has much to do with the menu of diploma options (i.e., advanced diploma, standard diploma, modified diploma, and special diploma) now available in the No Child Left Behind (NCLB) era (Abrams & Gerber, 2008).

With the advent of accountability tests tied to high school diplomas, other options emerged in states across the country. Krentz, Thurlow, Shyyan, and Scott (2005) have found that 27 states have mandatory exit exams tied to standard graduation diplomas. Moreover, Sullivan et al. (2005) have identified 14 states that offer some type of special diploma or certificate of attendance instead of standard diplomas. However, these new developments have not yet been thoroughly investigated. Without question, the form of diploma received upon leaving school has an effect on the transition options available in the beyond-high school years. For example, in some states, graduating with a modified standard diploma permits admission into community colleges

that subsequently have articulation agreements with four-year state universities if satisfactory academic progress is demonstrated.

EVALUATION OF TRANSITION SERVICES

Successful transition is predicated on effective transition preparation that occurs in the latter years of high school programming. Much of the script of preparation is guided by the contents of the IEP, ITP, and SOP—all of which are subsumed under the current mandatory special education law, IDEIA. Ultimately, once students with LD leave school, they enter into a new culture unlike the one experienced during their school-age years, one in which they have to assume the role of being adult. The requisite skill set is different, and the situations that need to be navigated on a daily basis are both predictable and unpredictable. Therefore, transition curriculum is very important, because for many students with LD, high school will be their last experience in formal education.

In 1987, the Council for Exceptional Children (CEC) Division on Career Development published its first position paper outlining issues regarding the transition from school to adult life (Halpern, 1994). It was a forwarding-thinking paper that projected the issue into the 21st century. The official definition of *transition*, stemming from P.L. 101- 476, IDEA, was as follows:

> Transition services means a coordinated set of activities for a student, designed within an outcome-oriented process, which promotes movement from school to post-school activities, including post-secondary education, vocational training, integrated employment (including supported employment, continuing and adult education, adult services, independent living or community participation" (Section 300.18).

Subsequent to the passage of IDEA and in response to the growth and sophistication of all aspects of transition, the Council for Exceptional Children's Division on Career Development and Transition (*Transition* added to their division name) adopted a more extensive definition and conceptual framework for the area of transition.

> Transition refers to a change in status from behaving primarily as a student to assuming emergent adult roles in the community. These roles include employment, participating in post-secondary education, maintaining a home, becoming appropriately involved in the community, and experiencing social and personal relationships. The process of enhancing transition involves the participation and coordination of school programs, adult agency services, and natural supports within the community (Halpern, 1994).

To date, the only work (albeit somewhat dated) done on evaluation of high school transition programs from an LD-specific perspective was by Rojewski (1992). In a departure from the prevailing thinking of program evaluators who approached programs that serve "mild handicaps" (high-incidence disabilities) from a generic standpoint, closer attention was given to the specific challenges of students with LD. This approach was prompted by writers such as Edgar (1987), who pointed out that when it comes to the grouping of mild disabilities, "It seems that they [the combined disabilities] are different populations with different needs, probably requiring different interventions." (p. 559).

In reviewing program components of nine selected federally funded demonstration model programs (not an exhaustive list), Rojewski (1992) identified seven exemplary components that were crucial in fostering successful transition to postsecondary educational and employment settings: (1) individual planning and

coordination, (2) vocational preparation, (3) academic remediation and support, (4) academic, vocational, and social-personal counseling, (5) support systems and services, (6) job seeking and placement, and (7) individual follow-up and follow-along evaluation. Furthermore, he pointed out that these components were probably germane to the broader population of students with high-incidence disabilities as well.

Rojewski (1992) provided several recommendations in his work. First, transition programs should be designed to include the components identified in his analysis. Second, programs should be flexible to meet the diverse needs of transitioning students with LD. Included in his notion of flexibility was the need for ongoing support in areas of functioning such as employment and community adjustment. Third, transition programs should have ongoing evaluation in order to measure what worked and what needed improvement. Last, both national and regional research efforts should be instituted to address the myriad of issues that are faced specifically by individuals with LD in their transition from school to adult life.

Note: The Rojewski work was done after the passage of ADA in 1990, but before its implementation in 1992. Furthermore, Rojewski did his work prior to the NCLB era, when more diploma options were created for students with disabilities, including LD. This positive development (a continuum of diploma options) has been offset by a focus on high stakes (accountability) testing in order for students to achieve a graduation diploma. Currently, there is no indication that more time and effort is being used for transition planning and preparation. In fact, more instructional time might be used to prepare students with LD for high-stakes tests.

A NEW ADDITION: SUMMARY OF PERFORMANCE

The SOP has yet to be researched because 2007–2008 was its first year of implementation. However, its design positions it to be the key instrument for transition for students with LD. It is not in any way a substitute for the Individual Transition Plan (ITP). Currently, its utility and effectiveness are not known because many professionals who serve individuals with LD simply do not know about it. Nevertheless, it has a great deal of promise for persons with LD who in their beyond-school years access special needs services in postsecondary settings.

The SOP was included in the reauthorization of the IDEIA in 2004 and is linked with the IEP process. The language of the provision covers students whose eligibility under special education procedures terminates due to graduation with a regular diploma, or exceeds the age of eligibility, and places responsibility on the local education agency (LEA). LEAs "shall provide the child [student] with a summary of academic achievement and functional performance, which shall include recommendations on how to assist the student in meeting the student's post-secondary goals" (Section 300.305 [e] [3]). The provisions of law state that "recommendations should not imply that any individual who qualified for special education in high school will automatically qualify for services in postsecondary education or employment settings. Postsecondary settings will continue to make eligibility decisions on a case-by-case basis. The SOP is thought to be most effective if it is developed in the student's final year of high school. The SOP has five parts mandated by law:

1) *Background Information*—Including most recent formal and informal assessment reports as well as functional limitations.
2) *Student's Postsecondary Goals*—Indicating what postschool settings to transition to upon leaving school.
3) *Summary of Performance*—Including academic, cognitive, and functional levels of performance. Also included are accommodations, modifications, and assistive technology that foster academic progress.

4) *Recommendations*—To help students meet post-secondary goals, including accommodations, assistive technology, and support services that can be used in education, training, employment, daily living, and community participation.
5) *Student Input*—Related to Summary of Performance. This section is intended to be done by the student alone, but it can also be done with assistance. It is linked to the broad area of self-determination.

The template for the SOP was developed subsequent to the passage of the 2004 reauthorization. It was developed by the National Transition Documentation Summit (2005), which included input from the Council for Exceptional Children's Division on Career Development and Transition and its Division on Learning Disabilities, the National Joint Committee on Learning Disabilities (NJCLD), the Learning Disabilities Association of America (LDA), and the National Center for Learning Disabilities (NCLD). While the SOP is not an LD-specific document, it should be noted that almost all the constituent groups invited to the summit were representatives from the LD community.

In theory and practice, the SOP is available to provide a wide variety of specific information to guide professionals who will work with individuals with LD in settings beyond their high school years (Izzo & Kochhar-Bryant, 2006; Lamb, 2006). It provides a starting point for programming and services beyond the school-age years not seen since the first federal mandatory special education law, P.L. 94-142, in 1975. In a departure from past practice, special needs professionals in adult education and two- and four-year colleges will have a plethora of LD-specific data that will provide important starting points for placement, teaching, learning, and testing. If used wisely, it can have a significant impact on retaining and graduating students in LD postsecondary programs.

To date, only a report from the Learning Disabilities Association of Virginia (2006) provides commentary on practice concerning SOPs. It reports that in Fairfax County, Virginia, the case manager, counselor, or special education coordinator completes the SOP in isolation with no input from teachers, parent, or student (despite the guidance provided in template item 5 above). Moreover, there are no statewide guidelines for the SOP. It has suggested that the student's final transcript be part of the SOP file, even though it is not available until after the student has graduated from high school.

SELF-DETERMINATION IN THE BEYOND-SCHOOL YEARS

Embedded within the position statement and at the heart of transition are the issues of empowerment and self-determination. In a general sense, these issues are relevant to all disabilities. The degree to which they have been realized is contingent on cognitive ability, functional skills, and support. When considering the specific profiles of persons with learning disabilities, the area of self-determination needs to be nuanced to bring greater meaning to prognosis and outcomes.

Unfortunately, self-determination suffers from conceptual confusion and is difficult to operationalize. Algozzine, Browder, Karvonen, Test, and Wood (2001) in their meta-analysis of the self-determination literature point out that sometimes it is framed as an intervention, and other times it is treated as an outcome. A synthesis definition produced by experts in the area (Field, Martin, Miller, Ward & Wehmeyer, 1998) simply states that self-determination is "a combination of skills, knowledge, and beliefs that enable a person to engage in goal-directed, self-regulated, autonomous behavior" (p. 2). "If self-determination is an intervention that culminates in an outcome or series of outcomes, then self-determination is best described as a set of personal characteristics…

achieved through lifelong learning, opportunities and experiences." (p. 22).

In addition, Ward (1992) asserted that self-determination includes self-actualization, assertiveness, creativity, pride, and self-advocacy beginning in early childhood and continuing into adult life. These are the attributes of those with LD who must navigate the complex interactions of adult settings mostly on their own. Moreover, the challenges can be daunting. Field (1996) stresses that there are unique barriers to self-determination when one has LD, an invisible disability. Self-disclosure, part of the wide array of self-determination issues, becomes a choice linked to one's understanding of strengths and weaknesses and an acceptance of self (Field & Hoffman, 1994). Moreover, lack of self-awareness and issues of self-esteem hinder self-determination. Smith (1989) has added that self-deprecating attributions and learned helplessness pose barriers as well.

Algozzine et al. (2001) used meta-analysis to gauge the effectiveness of self-determination programs in school-age programs. They reviewed 51 studies from 1978 to 2000. Of the 51 studies, only four (Van Reusen, Deshler, & Schmaker, 1989; Phillips, 1990; Aune, 1991; Van Reusen & Bos, 1994) contained a pure LD sample, and five had samples that had aggregated LD with other disabilities. The findings of the four studies are listed below as described in the meta-analysis.

Van Reusen et al. (1989) taught IEP participation strategies that included self-advocacy and self-awareness to 16 students, ages 16 to 18. The training was a five-step strategy called IPARS (inventory, provide information, ask questions, respond to questions, and summarize IEP goals). The results of the program showed that students were capable of providing information for their IEP and reflected more on individual goal statements.

Phillips (1990) studied 15 students ages 13 to 16 with LD in a four-year comprehensive high school. Students were guided by a multistep self-advocacy plan that included instruction in personal planning strategies to enhance self-awareness, goal setting, attainment skills, and self-advocacy skills. Qualitative data showed greater knowledge of services and rights, and awareness of career and educational outcomes. Student self-advocacy plans helped students to understand themselves and have a chance to speak about what happens at school. Some parents reported changes in students, but attempts to determine whether or not the effects of the program were successful were inconclusive. However, resource teachers viewed the program as being positive.

Aune (1991) studied 55 high school juniors and seniors with LD. Skills taught were self-awareness, career and postsecondary education exploration, self-advocacy skills, and intervention skills—all targeted from prior assessment. Intervention occurred in high school settings by a transition counselor, through optional group sessions in the summer and by postsecondary counselors in groups or by phone. Results showed no statistical significance for any of the skills listed above. However, self-reports from students showed self-awareness and self-advocacy skills improved in some areas. There was a significant increase in the size of support networks. The majority of goals set before intervention were attained.

Van Reusen and Bos (1994) studied 21 students with LD ages 14 to 21 and their parents. Participants received training about actively participating in IEP conferences. Researchers held a series of sessions for both students and parents. Students were taught a five-step strategy. The treatment group (students with LD) provided more goals and information during conferences, knew more about their strengths and weaknesses pertaining to their LD, and had more insight into career aspirations as determined by informal interviews. Anecdotal reports from teachers and parents indicated that some students used this information while interviewing for jobs and admission to postsecondary schools. One student received accommodations as a result of his self-advocacy efforts.

In another study, not part of the Algozzine meta-analysis, Collet-Klingenberg (1998) used a qualitative case study methodology within a grounded theory framework to investigate transition from a more holistic perspective. This approach is characterized as "a case of a larger phenomenon" by Marshall and Rossman (1989) that Collet-Klingenberg used to describe the elements of a successful transition program for students with LD in a rural Wisconsin school district. The school was chosen to participate in a statewide systems change project in transition because of its known success. The program served 10 students with LD within a school of 111 students. Data were collected over a 9-month period via 20 visits and more than 80 hours of interviews. Results showed that best practices contributing to the success of the program were vocational-related instruction, transition-related instruction, and transition-planning activities. In addition, self-determination skills were emphasized in the program as well as follow-up support. Linkages were built to outside agencies and vocational placements while the students were in school.

In a qualitative research study, Gerber (1992 a, 1998) followed a male, 30-year-old, newly prepared learning disabilities teacher with a diagnosed LD through his first 2 years of teaching in a school-to-school-to-work transition. Gerber analyzed the data from a framework of vocational success derived from a qualitative study researching 70 successful persons with LD (Gerber, Ginsberg, & Reiff, 1992). The study surfaces a philosophical and practical point, still not answered, when considering transition: If transition begins at job entry, when does it end? The study describes a very successful transition year, albeit one that was filled with many challenges stemming from the subject's LD. Success emanated from (1) clearly understanding his strengths and weaknesses, (2) knowing how to advocate effectively for himself, (3) being able to seek needed supports, and (4) working in a job role that was "fitting" to his profile as an adult with LD. The conclusion of the research report of year 1 stated,

> His accomplishments in year one portend the beginnings of a successful teaching career, but year two may not be any easier, nor any year after that. This may be the fate of one who has a learning disability. It does not, in the smallest way, diminish the competence, talent, and qualifications TJ has shown in his first year of teaching" (p. 231).

In fact, year 2 was unlike year 1 in a variety of ways. The LD teacher had a new caseload of more students (some with more severe challenges), new colleagues in special education in his school, a new principal, and more demands as a second-year teacher. Ultimately, he "made it" through his second year with a modicum of success. However, it was not difficult to surmise that it was a very difficult year. That led to the conclusion (Gerber, 1998),

> One year at a time.... Realizing that to some degree each year is a year of starting over again when one has a learning disability. It is part of the pleasure in accomplishment and achievement, and it is part of the frustration and the pain (p. 59).

The TJ study is instructive in demonstrating that being LD and an adult is very complex. Therefore, transition preparation and skill development in the area of self-determination must be viewed as complex as well. There are no shortcuts and no "cookbook approaches" when it comes to self-determination. Thus, there is no substitute for being prepared for the metacognitive tasks when incorporating the elements of "self" into everyday functioning. These are self-knowledge, self-understanding, self-disclosure, self-advocacy, and self-actualization. The example of TJ shows that there are trials as well as triumphs in

adulthood. Each day is a challenge, and there is no absolute formula for success. This is not just the adult LD experience; it is the adult experience. That is the transcendent theme that should be remembered by teachers (adults) who teach students on the cusp of adulthood as well as adults who teach other adults in postsecondary settings.

All the studies discussed, with the exception of the TJ study, were designed to measure some aspect of self-determination in the latter years of school. It is possible that the self-determination curriculum goals in transition programs serve the purposes of the school environment only. Generalization to other environments (particularly beyond school) is another issue. It is helpful at this juncture to see the extant literature for what it is and accept the premise that self-determination in adulthood may, in fact, be a very different skill set, albeit an extension of the self-determination themes taught in high school.

PREPARATION FOR SELF-DETERMINATION FOR TRANSITION AND BEYOND

The most popular instructional program for school-age students is Steps to Self-Determination (Field & Hoffman, 1996), which uses their model of self-determination. Ten "cornerstones" were used in the curriculum: (1) establishing a colearner model for teachers, (2) emphasizing modeling as an instructional strategy, (3) using cooperative learning, (4) promoting experiential learning, (5) using an integrated environment, (6) accessing support from families and friends, (7) emphasizing the importance of listening, (8) incorporating interdisciplinary teaching, (9) using appropriate humor, and (10) capitalizing on teachable moments (Hoffman & Field, 1995). The curriculum was field tested in two high schools with both a nondisabled and disabled population. A total of 47% of the sample contained students with LD. The program showed a significant increase in self-determination skills as evidenced by a program evaluation measure. Knowledge as well as an increase in student advocacy behaviors was correlated to self-determination for the LD population. Steps to Self-Determination is one of many programs that purport to teach self-determination. However, it is the only one that has data (albeit limited) describing its efficacy. Moreover, it is the only program that has included students with LD in its validation study.

Merchant and Gajar (1997) conducted an in-depth analysis of seven programs that claimed to deliver a self-advocacy component designed for students with LD who were transitioning from school to postsecondary settings. In evaluating program components, they identified four skills associated with self-advocacy listed by the programs: (1) understanding of one's own disability, (2) knowledge of legal rights, (3) needed accommodations, and (4) effective communication skills. They then evaluated each program to see to what extent the programs delivered instruction in those areas. All the programs taught students with LD to understand their learning disability, five of the seven taught communication skills, and four of the seven taught legal rights pertaining to the LD as well as accommodations. Merchant and Gajar cited a lack of research in this area and called for greater emphasis on research, including longitudinal designs, pertaining to the effectiveness of self-advocacy preparation.

In a study done by Gerber, Price, and Mulligan (2007), a missing component of transition preparation linked to self-determination was identified as knowledge pertaining to the ADA. With the knowledge that the extant research literature revealed that the ADA was markedly underutilized in the workplace, the investigators sought to discover the prevalence of ADA materials in school-age transition and personnel preparation programs. Selected materials were chosen according to four criteria: (1) author's history of scholarship and standing in the field, (2) availability of materials either printed or via the Internet, (3) target audience for the LD community, and (4) materials representing the best practices in the field. In all the

materials, the ADA was mentioned only once and in a very cursory manner. The conclusion of the authors was that "the transition literature has not kept up with the needs of individuals with LD in this critical and frequently neglected area" (p. 344). Moreover, the findings provided further explanation of why there was very little self-disclosure in employment for persons with LD (Price, Gerber, & Mulligan, 2003; Price, Gerber, Mulligan, & Williams, 2005).

The call for more research in the area of self-determination for persons with LD by Merchant and Gajar (1997) and more relevance in transition preparation by Price et al. (2003) is warranted. There is relatively little research investigating self-determination in the workplace. Currently, it is only known that some transition curriculums are effective while in high school transition programs, but there is a disconnect when students with LD leave school and enter into beyond-school environments. In fact, there might be a profound disconnect between what is taught under the broad heading of self-determination and the reality of adult environments. For instance, self-disclosure is a process that is easily taught in school (i.e., a more supportive environment), but it becomes more complex in employment settings where stigma and issues of self-esteem are at risk.

SELF-DISCLOSURE: AN ELEMENT OF SELF-DETERMINATION

The Gerber and Price (2006) national qualitative study of 70 adults with LD and their preliminary study in 2005 with Mulligan and Williams provided greater understanding and nuance to the complex process of self-disclosure. Because LD is invisible, it poses a different set of dynamics than other disability areas. Using the work of Goffman (1963), the authors framed self-disclosure as management of personal information that needs to be contextualized for its potential impact, both positive and negative. The dichotomy that emerged from the data analysis was acceptable loss and potential gain mediated by personal risk assessment. Risk assessment factored into such issues as stigma, threat, ostracism, and misunderstanding vs. greater understanding of others and productive use of laws (Section 504 and the ADA) that provide protections against discrimination in two adult contexts—education and employment. Ultimately, the issue of being LD or not LD was an adult choice that fit under the rubric of self-determination.

The onus of self-disclosure and self-advocacy was first identified in the workplace by a Gerber (1992 a) study at the inception of the ADA era. Nine employers from moderate- to large-sized businesses were interviewed regarding their observations, feelings, and expectations about the adults with LD with whom they worked. All of them were quite perplexed about the nature of LD, and wanted their employees to be knowledgeable about their LD, to be able to discuss its implications in their work context, and to help provide information regarding accommodations. Nearly a decade later, a follow-up study in 1998–1999 by Price and Gerber (2001) took a second glance of the impact of ADA. They found that employers still had the same expectations, but were disappointed in the self-advocacy efforts of their employees with LD. The conclusion of the study was that more needed to be done in the area of self-advocacy before students with LD left school and entered the workplace. Employers were willing to hire employees with LD, but they wanted those who sought to "invoke some or all of the provisions of the ADA to understand their implications and boundaries" (p. 133).

Madaus, Gerber, and Price (in press) compiled a series of studies linked to these findings and derived three lessons. First, adults with LD are largely unaware of the ADA. Second, disclosure and accommodation use are unusual in the workplace. Third, if the ADA is to reach its full potential, students with LD in transition programs need to learn self-advocacy skills relative to the ADA. They reiterated a conclusion of the

Price et al. (2003) study of students with LD who went straight to work after high school. There was a disconnection between the realities of the workplace and curricular practices in transition preparation:

> The realities of the workplace currently do not match the prevailing wisdom of the field of learning disabilities, that the ADA, accommodation, and self-disclosure are supposed to change the culture of work and provide more opportunity for those individuals… (p. 357).

A somewhat different scenario was discovered when Madaus, Foley, McGuire, and Ruban (2002) studied 132 predominantly white male graduates from a large state university. Of the graduates, 85.5% were employed full-time (considerably higher than the overall employment rate of persons with LD) and were making competitive salaries. However, only 30.3% reported they disclosed their LD to their employer, despite the fact that 90% said that their LD affected their work in some way. Of those who did not disclose, 60% said that there was not a reason to disclose. However, others were reticent to do so because they were concerned about potentially negative consequences between them and their coworkers or fear about job security.

All that encompasses self-determination and two of its key elements—self-disclosure and self-advocacy—is viewed as being central to transition and successful adjustment to adulthood. It is readily acknowledged that self-determination skills are important in postsecondary settings. Merchant, Ofiesh, Gajor, and Hughes (1996) discovered their importance in a nationwide survey of postsecondary programs that teach self-advocacy skills. Yet, it was emphasized that programming and services related to self-determination and self-advocacy dramatically diminished once LD students leave high school, increasing the importance of instruction in this area before departure. In fact, the latter years of high school provided a last chance to teach self-determination skills that can be used beyond transition and during the many years of adulthood (as noted above). This observation has much to do with the differences seen in the "lessons" portrayed by Madaus et al. (in press) and the study done by Madaus et al. in 2002.

The issue of self-determination for adults with LD is complex because adulthood in itself is complicated. There are many options to be considered, and many choices to be made on an ongoing basis. The issues subsumed under self-determination (e.g., disclosure, advocacy) are context specific and developmentally challenging. Therefore, the disconnect that is evident in transition preparation during the latter years of high school is not surprising. Because learning disabilities in adulthood are characterized by intra-individual differences such as intelligence, processing, academic achievement, adaptive behavior, and severity, it can be overwhelming to envision the many issues that fall under the general heading of self-determination. One fact is clear: Self-determination is the essence of adulthood. Without a firm understanding of its issues and implications, an adult (whether LD or nondisabled) may be only marginally adjusted to adulthood if the concept of self-determination is not thoroughly realized through the many phases of adult development—day by day and year to year.

Discussion, Conclusions, and Recommendations

Emerging from secondary school curriculums, including preparation for transition to the beyond-school years, the markers for success for individuals with LD can be agreed upon in principle: (1) job

stability in competitive employment, (2) living independently, (3) managing one's daily affairs in a satisfactory manner, (4) maintaining social and interpersonal relationships, (5) participating in community, and (6) becoming an integral part of family. Clearly, these challenges in composite are the profile of adults, whether nondisabled or LD, who have become truly adult. However, making success operational in concrete terms is problematic. The question that transcends the more practical focus on transition and its processes is, "When does transition end?" The LD literature provides no answers. The adult development literature provides the view that transition is endemic to the progression of phases of adulthood experienced during the span of adult years. Moreover, transition becomes a complex concept driven by goals in a variety of adult domains. Goal attainment is an amorphous standard that is replete with values, cultural expectations, and societal norms. It stems from solid educational preparation, good planning, adequate support, and sometimes, pure luck.

The original thinking of transition in the early 1980s for persons with LD focused on work. The tracks of school-to-work and school-to-school-to-work created a time-limited concept that inferred an end point upon job entry. Employment stability is central to adult adjustment and is the underpinning of autonomy and self-determination. So much emanates from successful employment. In fact, all the adult behaviors listed above can be used as criteria for markers of success.

When individuals with LD leave school, they enter a world unlike that of their school-age years. Typically, it is a world in which transition services and supports diminish or even vanish if they go straight to work. If they attend a two- or four-year college program, or participate in adult education, literacy centers, rehabilitation services, or job training centers, transition supports exist in a variety of forms (depending on resources, expertise, and accessibility).

The ultimate question becomes how best to facilitate success in the beyond-school phase of transition. Literacy of all kinds increases the possibility of success in adulthood as well as completion of two- and four-year postsecondary programs and other postsecondary programs. In composite, the skill set of adults with LD, whether limited or elaborate, must be used throughout a long period of time in a variety of challenging roles and contexts. However, there is no guarantee of success, nor is there a blueprint.

RECOMMENDATIONS

Research recommendation #1. Research in the area of transition and LD needs to be brought in line with the scholarly standards of the field of LD as described by the Council for Learning Disabilities Research Committee (1993). The issue of researching LD as part of a high-incidence generic category is problematic. Therefore, after the population of students with LD is vetted for research purposes, it seems unproductive to group them together with other "high-incidence disabilities" if we are to achieve meaningful results to inform practice with any sort of precision. If a "high-incidence" disabilities population is necessary for the research design, it is also important for investigators to disaggregate the data on a disability-specific basis. It is with this action that the LD data can bring specific meaning and potentially provide direction for practice. Of concern is the aggregation of students with attention deficit disorder in large well-funded studies such as NTLS2. This practice is also becoming more common in reporting statistics made available by the U.S. Department of Education. Placing LD and ADD together for reporting purposes is not a helpful step in the right direction for researchers or practitioners.

Research recommendation #2. Research in the area of transition rarely takes a comprehensive view of the process. Moreover, it suffers from studies that investigate one or two issues at one point in time. Often, the choice of timing is arbitrary. In order to discover the salient issues of transition,

longitudinal designs are needed incorporating multiple data points. A good example is the case study cited in this chapter by Gerber (1992), who studied the process of transition from school-to-school-to-work over 2 years with data collection occurring on a monthly basis.

PRACTICE

Practice recommendation #1. One of the more promising practices to emerge in a number of years is the Summary of Performance (SOP) mandated in IDEIA. Currently in its first year of implementation, SOP has not been researched to investigate its utility for programs receiving students with LD, such as adult education, literacy centers, and two- and four-year colleges and universities. It is important to discover how effective the presenting information is in the SOP for the receiving program, what information is missing, and what should be added. This document has the potential to markedly upgrade practices and services for adults with LD beyond the K–12 years, particularly in two- and four-year college programs. While the SOP has not been developed with employment in mind, it also has utility in that context—particularly in determining "essential functions" and providing for "reasonable accommodations."

Practice recommendation #2. Currently, there is no research on computer literacy education and students with LD. There does not seem to be a conceptual framework that guides what should be taught during the transition years and what level of competency should be established for a wide array of computer-based skills. This gap seems to be growing exponentially as technology takes a greater hold on much of what is done in the United States and the "flat world" (Friedman, 2007) on a daily basis. Competence in the area of Internet skills (including reading) is important, as it is used more and more for communication, information retrieval, and leisure/recreation.

Practice recommendation #3. Assistive technology for persons with LD has proven to be valuable in compensating and accommodating for challenges in basic skills and other issues associated with LD. Oftentimes, technology can provide an "educational bypass" that can make a difference in efficiency and achievement in such contexts as education and employment in the beyond-school years. This area needs to be studied more on an LD-specific basis (during transition and in postsecondary settings), and should be considered as having great potential in the lives of young adults with LD transitioning from school-to-school or school-to-school-to-work.

Practice recommendation #4. The potential of the SOP cannot be underestimated for individuals with LD. It is important for those teaching in postsecondary settings to know (1) that SOPs are mandated for each graduating student with LD, (2) what information is provided, and (3) how to plan for individual educational programs consistent with the baseline data, accommodations, and self-determination information provided. Using the data from the SOP should lay the groundwork for consistency of approach and diagnostic data to address the intra-individual differences found in persons with LD.

CONCLUSION

Ultimately, the entire effort of transition planning and preparation is to provide a solid foundation for the wide variety of skills needed to function independently and adapt successfully in adulthood. That is a yeoman's task. Arguably, the transition process on the K–12 side is the easy part. The beyond-school part for persons with LD, which can be characterized as "going it alone," is filled with numerous challenges—some anticipated and prepared for, and others unanticipated and daunting. In order to best prepare for the beyond-school years, it is important for transition personnel and parents to be aware of the realities of adulthood and all its contexts. In essence, what

research tells us about is the impact of LD throughout adulthood. If that body of research is viewed as separate from transition, then its importance cannot be valued, nor can it be used to inform practice in the latter years of school-age programming. Chapter 7 will attempt to address that need.

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Chapter 7
Impact of Learning Disabilities on Adults

Paul J. Gerber

Introduction to the Topic

Because learning disabilities (LD) are a heterogeneous cluster of cognitive disabilities (with many subtypes), there are a myriad of adult outcomes to consider. When reviewing the LD literature, it is common to read about highly successful adults, those who are moderately successful, and others who are either marginally adjusted and/or totally dependent on others (Gerber & Reiff, 1991). Moreover, by nature, adults with LD can be placed a continuum of severity, ranging from borderline/low average intelligence to superior intelligence (Reiff & Gerber, 1991). Complementary to the issue of severity is a range of adaptive behaviors that can have implications for daily functioning, and social skills that must be executed effectively in a wide variety of adult contexts (Gerber & Reiff, 1991; Roffman, 2000). Issues of comorbidity are also part of the LD adult experience. It is not uncommon for adults with LD to have ADD/ADHD, anxiety, depression, personality disorder, and age-related conditions (Gerber et al., 1990). Therefore, the mantra in the area of adults with LD is "one size does not fit all." It is not surprising to find outcomes for adults with LD to be very, very diverse. In essence, the impact of LD can take on many forms, with a whole host of challenges.

The stage of adulthood also poses an interesting set of dynamics. Upon entering adulthood, the longest stage of human development, people can have as many as 70 years ahead. However, the adult stage of development can best be thought of in phases, ranging from early to middle to late adulthood (Erickson, 1963; Havighurst, 1972; Gould, 1978; Levinson, 1978, 1986). Numerous adult development theorists have conceptualized a sequence of development that provides a useful framework, but none specific to adults with LD. However, when judging the developmental challenges of any or all phases of adulthood for those who are LD, it is helpful to refer to adult development frameworks for guidance (Bassett, Polloway, & Patton, 1994; Gerber, 1993).

Those developmental challenges provide a matrix for adult functioning. The adult phase of development is cross-referenced with domains of functioning. Those domains vary depending on adult theorists, but they typically include employment, family, personal-social, etc. The prognosis that emerges from the literature is a path of competitive employment, independent living, family involvement, community participation, leisure and recreational pursuits, and possible continuing education. These areas of functioning are germane to adults with LD as well.

Unlike the school-age years, the LD adult experience is not centered on education. In fact, LD may be viewed by adults with LD as an educational construct, only being school specific. Moreover, because of the invisibility of LD, disclosure becomes a choice in adult settings mediated by the dynamics of risk and reward. The ultimate question for adults with LD is "To be LD or not to be LD?" (Gerber, Price, Mulligan, & Williams, 2005). There are legal

protections emanating from Section 504 of the Rehabilitation Act of 1973 and the Americans with Disabilities Act of 1990 (ADA) that are germane to adults with LD; however, these laws are only relevant to education and employment.. The rewards are use of the laws to prevent discrimination, to gain equal access, and to provide "a level playing field" when competing with nondisabled peers. The risks are misunderstanding, stigma, self-esteem issues, and social isolation reminiscent of the school-age years (Gerber & Price, 2006).

Thus, adult education and the pursuit of literacy are only two of the many facets of the lives of adults with LD. Potentially, there are a myriad of other adult challenges and goals as well. Generalizing about the impact of LD in adulthood can be complicated. It must be nuanced in order to capture its complexity. Without question, there are trials and tribulations in every phase of adulthood, from day to day and from year to year (Gerber, 1992a, 1994). At the same time, there are many good examples of successful adjustment where adults with LD have achieved a good quality of life— finding their niche by focusing on their strengths and compensating for weaknesses within their individual profile (Gerber, Ginsberg, & Reiff, 1992; Reiff, Gerber & Ginsberg, 1997).

Literature Search

The literature search on the impact of learning disabilities in adulthood focused on research in the following databases: ERIC Clearinghouse, PsycINFO, Infotrac One, Academic One File, and Dissertation Abstracts International (DIA). In addition, searching by hand was done in a number of journals from the last 17 years (since the passage of the Americans with Disabilities Act in 1990), including *Journal of Learning Disabilities, Learning Disability Quarterly, LD Research and Practice, Remedial and Special Education* and *Thalamus.* One exception should be noted. The Rogan and Hartman (1986) study was included because it is considered one of the seminal outcome studies of adults with LD. In addition, only articles published in refereed journals were included.

Web sites pertaining to the topic were also searched as well: Division on Career Development and Transition (CEC), International Dyslexia Association (IDA), Job Accommodation Network (JAN), LDOnline.org, Learning Disabilities Association of America (LDA), Learning Disabilities Association of Virginia, National Center for Learning Disabilities (NCLD), National Center for Special Education Research, National Center for the Study of Adult Learning and Literacy, National Collaborative on Workforce and Disability, National Institute for Literacy (NIFL), National Joint Committee on Learning Disabilities (NJCLD), National Longitudinal Transition Study (NLTS2), SchwabLearning.org, and the U.S. Department of Education.

The search was disability specific in nature. Only the terms *learning disabilities* and *dyslexia* were used. The terms *mildly disabled* and *high-incidence disabilities* were not included. Excluded from the search were articles pertaining to learning disabilities in British journals. In the United Kingdom, learning disabilities are an umbrella term including such conditions as mental retardation and developmental disabilities. ADD and ADHD were not searched as primary disabilities. They were included for the purposes of reporting a small select set of data reported from the NLTS2 data. All writing was considered, but preference was given to work done in the post–ADA era beginning in 1990.

All work cited in this review was vetted via the standards of the Council for Learning Disabilities Research

Committee (Rosenberg, 1993). These guidelines were formulated for investigators to design and implement research studies in the field of learning disabilities. The research review on low-literate adults with learning disabilities cited in chapter 2 was done with the standards set by the National Reading Panel (2006).

The search for the literature in the area of impact of learning disabilities in adulthood was driven by a primary question to guide the review of the evidence-based research: "What do we know about the LD adult experience that informs practice for transition preparation and adult education that can foster positive outcomes in the beyond-school years?" Excluded from the search was substantive research on persons with LD who continued on to higher education after their school-age years.

The following search terms were used for all searches:

1) adults with learning disabilities
2) adults and dyslexia
3) learning disabilities outcomes
4) learning disabilities longitudinal studies
5) learning disabilities follow-up studies
6) self-determination and learning disabilities
7) adults with learning disabilities and comorbidity
8) contexts of adults with learning disabilities functioning
9) risk and resilience and learning disabilities
10) highly successful adults with learning disabilities
11) low-literate adults with learning disabilities
12) aging and learning disabilities

View of the Research

It is noteworthy that the research literature in this area is sparse. Moreover, most of the scholarly work lacks methodological rigor. Another issue is the age of the adult population investigated in most studies. Despite the fact that the adult years begin around age 18 and spans as many as 70 years, studies of adults with LD are skewed toward early adulthood and rarely target adults beyond age 30. Moreover, most longitudinal studies are follow-up studies (typically having only 2 data points) that are chronologically compressed, yielding only partial data about long-term trends. Last, studies of adults with LD seem to lack a conceptual model regarding how to study adults with LD. Studies rarely address variables of adulthood (i.e., contexts and developmental phases) and tend to explain findings within a narrow perspective, failing to capture the "big picture" and the complexities of adult life. Oftentimes, findings from studies are not compared to adult norms or trends found in nondisabled adults.

The research that was used for this review came in a variety of forms. Besides the studies cited from the literature search, some basic information used for the introduction of this chapter was gleaned from books reporting research specifically pertaining to adults with learning disabilities. Designs of the research cited were both quantitative and qualitative in nature. Qualitative work cited used standard scientific methods as well as accepted scholarly procedures for case studies, ethnographies, surveys, and questionnaires. The area of adults with LD is not as well researched as other topical areas in learning disabilities. Therefore, at times, it was useful to refer to policy statements pertaining to LD by federal government agencies, professional associations and learned societies, and private and public vetted websites.

Report of the Findings

PREVALENCE OF LEARNING DISABILITIES

Ever since the passage of P.L. 94-142, the Education of All Handicapped Children Act, in 1975 (now reauthorized as the Individuals with Disabilities Education Improvement Act of 2004 or IDEIA), LD has been the highest-incidence disability category. According to data available from the National Center for Education Statistics (2005), the incidence of all students with disabilities ages 6–21 served under Part B of IDEIA was 9.15%. Of that percentage, those students served as being LD was 5.6%. From reporting year 2000–01 to 2005–06, the incidence range was 6.0 to 5.6%. That is by far the largest percentage of the 12 disability categories covered by the IDEIA mandate. In 2000, the NLTS2 reported that the number of students with disabilities in America's schools was 10.6%. The number of students with LD ages 13 to 16, the scope of their analysis, was 1,167,204, or 5.84%—the largest of any disability group. Consequently, each year thousands and thousands of students with LD leave high school and begin their adult lives facing a wide variety of challenges, leading to a broad array of outcomes.

There are other incidence indicators of adults with LD beyond the school-age years. The U.S. Department of Labor, Employment and Training Administration (1991), reported that 15%–20% of JPTA (Job Partnership Training Act) clients may have had LD. The Inspector General of the United States Department of Health and Human Services (1992) stated that LD was one of the two most frequently cited functional impairments of Aid to Families with Dependent Children (AFDC) (welfare) clients. Giovengo, Moore, and Young (1998) found that 36% of AFDC (now called TANF) were diagnosed as LD.

CONSIDERATIONS FOR DERIVING MEANING FROM FOLLOW-UP STUDIES

It is important to derive meaning from follow-up studies about individuals with LD, knowing that typically they are fraught with methodological limitations and, in some cases, methodological flaws. Robins (1977) described some common methodological problems found in follow-up studies. Those that are relevant to this review are (1) failure to control for a change in definitions over time, (2) failure to incorporate control groups into designs for comparisons, (3) failure to control for attrition, and (4) difficulty in predicting individual outcomes from group designs. The follow-up research on the impact of LD in the adult years is not immune to the above warnings. Therefore, the following research should be understood with those considerations in mind.

LEARNING DISABILITIES IN ADULTHOOD

While the research base pertaining to adults with LD is not extensive, there are a number of studies that have been done that shed light on the numerous issues of the beyond-school years. In order to view a progression of thought and findings, it is best to present the research on a chronological basis. Although the focus of this review emphasizes research since the 1990s, the important work by Dr. Laura Lehtinen -Rogan and her colleague Lenore Hartman (1990), pioneers in LD who worked with Dr. Alfred Strauss and Dr. Heinz Werner, is noteworthy.

Rogan and Hartman (1986) followed up their 1976 seminal comprehensive study of former Cove School students (a private school for students with LD in Evanston, Illinois), who were from middle and high socioeconomic status families. The purpose of

the study was to ascertain whether the findings of their previous investigation were still valid over the 8- to 10-year period since their first study. Their 88 original subjects were between 30 and 40 years old at the time of their second investigation. They divided the sample into three parts: 30 who completed 4 years of college, 34 who completed regular high school and had some experience with community college education, and 21 who attended self-contained LD programming before leaving high school. Three of their original sample had dropped out of school and were treated separately. Rogan and Hartman were able to locate only 68 individuals and obtained their data via questionnaire and telephone surveys.

They found that the positive trends seen in their 1976 study had continued for most of the subjects. For those whose future was in question in the 1976 study, there had been little improvement in the ensuing adult years. The basic skills of reading, math, and spelling continued to be a challenge in their adult years. The researchers attributed the positive outcomes they found to cooperation of families, early detection of LD, and intensity of remediation. They concluded that learning disabilities were "no longer the dominant feature of their adult lives." Moreover, they deemed all three groups successful in "maintaining their adult lives in the workplace and in their personal lives" (p. 102).

Haring, Lovett, and Smith (1990) followed up graduates of self-contained LD programs who attended school from 1983 to 1985 to investigate adult outcomes 1–4 years after leaving school. The sample consisted of 64 randomly selected graduates, 60% male and 30% Hispanic. A total of 24% had received vocational training in high school. Three life domains focused on were employment, residential environment, and social or interpersonal networks. The data were collected through a phone interview, which used a protocol that reflected the issues derived from the extant research on adults with LD at the time of inquiry.

A number of interesting findings were culled from the data analysis. Generally speaking, the outcomes demonstrated minimal adult adjustment. The unemployment rate of the sample was 31%, twice the national average, and more than twice the figure of the comparison group of young adults in New Mexico at that time. Only 35% of the sample went on for postsecondary training (none at two- or four-year college programs), but their education and training did not enhance their employability. Women were reported as underemployed, leading the researchers to observe that LD programs did not adequately address their beyond-school skills. A total of 60% were engaged in competitive employment, although the vast majority of the sample was not employed on a full-time basis. A total of 87% reported they were happy with their jobs. In the area of job search, surprisingly, most young adults with LD found their jobs through a family and friends network. Mobility around their community was not an issue. General satisfaction was noted in the social and recreational domains, although the researchers observed that they were limited to a narrow range of experiences.

Johnson (1994) reported her findings from a clinical study of 14 adults with LD. They were culled from a pool of 400 clinic evaluation files of the Northwestern University Learning Disability Center. The purpose of her study was to investigate the psycho-educational patterns of adults who were reading at the fourth-grade level or below and who had an IQ of 85 or above in either their verbal or performance IQ scores. Assessment measures included mental ability, reading, oral and written language, mathematics, and various cognitive skills. Developmental, educational, social, and occupational histories were included as well. All but two subjects had graduated from high school, and all of them were employed at the time of testing.

Upon completing the diagnostic work, Johnson and her associates implemented an intervention described as "individual and interactive." Typically,

emphasis of intervention was placed on vocabulary development, reading strategies, and written language in sessions from 60 to 90 minutes per week (duration not described). Progress was noted in four of the 14 center's clients. Three had progressed from third- or fourth-grade reading to seventh or eighth, resulting in their seeking higher-level occupational positions as well as enrollment in community college programs. The fourth client's progress had been slowed by time spent with family obligations. Those who went through the diagnostic process gained knowledge of their strengths and weaknesses as well as the realization that LD was not their fault. Johnson observed, "with motivation and individualized instruction even small gains may provide them [adults with LD] with more educational, occupational and social mobility" (p. 50). How their gains outside the clinic would actually impact their lives is very difficult to surmise. The key words of Johnson's statement in reporting the research were *may provide.* The design of this study did not provide a follow-up phase.

Post–high school outcomes of high IQ adults with LD were studied by Holliday, Koller, and Thomas (1999) to ascertain their occupational and social adjustment. Subjects were chosen from a pool of 3,500 from a large university clinic in Missouri. They had been referred for LD evaluation by the Department of Vocational Rehabilitation. In addition to meeting the standard definition of LD, clients also had to meet the Rehabilitation Services Administration (RSA) criteria for having functional limitations that impede the ability to work and engage in independent living. The authors noted that the vocationally oriented criteria used in their study were more stringent than most educationally oriented LD criteria—focusing on academic deficits such as reading, writing, and mathematics. Wechsler Intelligance Scale for Children-Revised (WISC-R), a popular intelligence test for children, full-scale IQ scores ranged from 94 to 131 with a mean of 114.35 (SD =8.78), classifying as "high-IQ adults." Mean performance IQ for the group was 122.21 vs. 106.25 for the verbal IQ score. A total of 92% had graduated from high school, but only 21% had completed more than 4 years of college, 5 years post–high school. The major finding was that 95% of the participants in the study had not been told of their exceptional abilities, not only while in school but also while being served by vocational rehabilitation services. Although individuals with LD had performed at the 90th percentile on cognitive measures, they were not told of their high aptitude and, thus, were not able to use the information in formulating vocational goals. Interestingly, the high-IQ adults were "functioning at levels consistent with their LD deficits rather than at levels commensurate with their identified intellectual strengths" (p. 266). These findings can be interpreted as a classic example of LD being looked upon as a "deficit model," while strengths—in this case, significant strengths—are overlooked or not utilized in identifying strategies to foster success fitting individual profiles. It is another example of how adults with LD ultimately find themselves in jobs in which they are "underemployed."

A qualitative/ethnographic study (Gerber & Reiff, 1991) explored the lives of nine adults with LD, ages 22 to 56, who were categorized as highly adjusted, moderately adjusted, and marginally adjusted to adulthood. It was the first time that the adult LD population was stratified according to a key variable, specifically using the construct of adjustment. They focused on an array of adult areas, including education, employment, social and emotional functioning, and daily living routines. Gerber and Reiff summarized the lives of the three subgroups:

> A wide variety of functioning was seen both within groups and between groups in the areas of inquiry. Degree of vocational success typically was a function of extent of education, and in some cases related to severity of impairment. Subjects who had

received advanced degrees were progressing successfully in their careers. Vocational success also characterized the group of moderately adjusted subjects despite a string of different jobs and an unsystematic transition from school to employment. All marginally adjusted subjects were unemployed and had no near term or long-range plans for education or training. Generally, their lives were noted for their dependency, whether with parents or with spouses. In the area of social and emotional functioning, the moderately adjusted group was qualitatively more proficient than the other two groups. They simply had an easier time navigating the many contexts of daily adult life with more ease and efficiency.

All subjects seemed to be very cognizant of their struggles during childhood. They were aware of the residual effects of LD in adulthood. Adulthood was not the end of their struggle, however. In their adult lives their hurdles seemed to be as numerous. However, they tended to be only as debilitating as the severity of their learning disabilities or the success of their own systems of accommodation (p. xiv).

A 14-year longitudinal study of young adults with LD, all diagnosed at the age of 10, sought to discover adult outcomes (Seo, 2005). A cohort of 60 subjects who were 24 years old in 2000 was studied. A quantitative analysis of outcome data revealed findings in a wide array of areas of adult functioning. After controlling for ethnicity, gender, and socioeconomic status, Seo found:

1. The rate of employment and earned income of adults with LD was not significantly lower than those of their nondisabled peers.
2. The highest postsecondary school attainment was not significantly different than that of their nondisabled peers at age 24.
3. Adults with LD were not significantly different from their nondisabled peers in committing crimes.
4. Adults with LD had significantly more symptoms of depression than their non-LD peers.

Gerber et al. (1990) investigated the persistence of LD well across the span of adult years. A group of 133 adults (81 males and 52 females), ranging in age from 23 to 71 (mean age 42.1) and categorized as moderately and highly successful with LD, were studied. Using a Likert scale from 1 to 7 (increasing levels of severity), subjects were asked to rate 13 characteristics of LD (e.g.,. listening, speaking, coordination, impulsivity, attention span)—both retrospectively (in school) and currently (in their present adult status). Both groups responded that their LD got worse when comparing their school years to their adult years. Some stability of LD characteristics such as speaking and spelling was noted as well. Roughly 25% or more of all respondents reported increasing difficulties in adulthood on every item. However, the authors pointed out that the findings might be a function of the ever-increasing complexities of work and daily routines as adulthood unfolded. Moreover, they commented that, after the issue of persistence of LD from school to beyond school had been established in the thinking of LD professionals, a new realization became part of the conversation—"that things do not get better over time, and that problems associated with LD can even get worse in the adult years" (p. 572).

Data from a follow-up study of 27 Dutch adults with dyslexia (Hellerendoorn & Ruijssenaars, 2000) revealed a wide array of outcomes. The severity range of dyslexia in the participants ranged from mild to severe, albeit 66% of the sample was described as having moderate severity. Participants ranged in age from

20 to 39 years (mean age 28.5 years). All respondents pursued some form of postsecondary training after completing high school, including 11 who attended a university program. The interview data were analyzed both quantitatively and qualitatively.

In adulthood, dyslexia still had an impact on the lives of the adults in the study, particularly in the areas of education and employment. Moreover, most respondents reported social and emotional problems. However, parental support was a powerful predictor of positive adult adjustment and well-being. Those in the study who had positive recollections of their school-age years evidenced more acceptance of their dyslexia in their adult years.

The studies investigating adults with LD are illustrative of a heterogeneous group of individuals whose commonality is simply that they are all LD. The focus of the studies above give us an indication of a wide variety of issues and challenges. That is a result of two factors. First, the focus of investigators' research targets discoveries in specific areas. Most important was the notion that "one size does not fit all" when it comes to LD, particularly adults with LD. There are too many mediating variables, such as cognitive ability, severity, context, self-determination, and support.

NATIONAL LONGITUDINAL TRANSITION STUDY 2

The National Longitudinal Transition Study 2 (NLTS2) provided a follow-up to its initial effort to study the outcomes of youth with disabilities 10 years after its first wave of inquiry. NLTS2 has provided data via a series of research reports focusing on different aspects of its efforts. The NLTS2 sample included a nationally representative sample of more than 11,000 youths, ages 13 and 16, who were receiving special education services for their disabilities in schools in Grade 7 or higher on December 1, 2000, for the reporting year 2000–01. Data were collected via phone interview and mail surveys with former special education students, representing each of the 12 special education federal disability categories, and their parents in spring through fall, 2003.

After High School: A First Look at the Post-School Experiences of Youth With Disabilities (Wagner et al., 2005a) provided interesting findings. When disaggregating the data, the following was reported about the LD population combined with the ADD/ADHD population noted as "other health impaired" in the report. (Note: This is the only time in this review that aggregated LD and ADD/ADHD data are reported together.)

1. About three-fourths of out-of-school youth with learning disabilities or other health impairments have completed high school, almost all of them with a regular diploma.
2. More than three-fourths have been engaged in school, work, or preparation for work since leaving high school, and about 45% were currently employed at the time of the Wave 2 interview.
3. About one-third were "definitely" expected by their parents to go on to postsecondary education after high school, and about that many have done so within 2 years of leaving high school. A two-year college experience is their typical pursuit.
4. Youth with LD and other health impairments have experienced the broadest changes in their leisure time and friendship pursuits, with large reductions in passive leisure activities (e.g., watching television or using the computer) and large increases in seeing friends often.
5. Although these youth are among the most likely to register to vote (about 70%), they also have experienced declines in participation in pro-social organized groups and volunteer activities.
6. Youth in these categories are second only to youth with emotional disturbances in the likelihood of being involved in the criminal justice

> system; those with other health impairments show only significant increases in arrest rates in the 2 years between Wave 1 and Wave 2 (2003) (p. ES-6).

The report contains a disclaimer affirming the great diversity of experiences of youth with disabilities once leaving school. It warns the reader that "it is important to be cautious in assigning either success or failure to transition outcomes achieved during this very early period after high school" (p. ES-10).

Other findings that are LD specific are contained in the 2004 report *An Overview of Findings From Wave 2 of the National Longitudinal Transition Study-2* (p. 3). They are the following:

1. Among out-of-school youth with LD or other health impairments, 87% and 78%, respectively, have been engaged in school or preparation for work since leaving high school, and about 45% were currently employed at the time of the Wave 2 interview.
2. Among youth with LD and health impairments, 27% and 33%, respectively, were expected by their parents "definitely" to go on to postsecondary education after high school, and 33% and 37% of the two groups have done so within 2 years of leaving high school. Enrollment in two-year colleges is most common (22% and 31%) (p. 11). (Note: These data are an elaboration of the data reported in item 3 in the Wagner [2005a] research report described above.)

In the report *Changes Over Time in the Early Post-School Outcomes of Youth With Disabilities* (Wagner et al., 2005b), a number of areas were reported. These included school completion; household arrangements and social activities; postsecondary education; employment; and engagement in school, work, or preparation for work. Unfortunately, when the data were disaggregated according to disability category, LD was not included despite its being the highest-incidence category of all school-age disability areas.

The findings that have been reported from NLTS2 are just a snapshot of the immediate years after leaving school. These are important years that lay the seeds of success and failure, consequences and unintended effects, during the adult years. Therefore, the data portend possibilities and no definite outcomes. Additionally, aggregating the "other health-impaired" category with LD does a disservice to the findings, which need much more nuance when investigating the complex issues of LD beyond the school-age years. The ultimate question is, without a comparison group, how do we know that the LD sample is much different than others who are in their early 20s? Credit goes to the NLTS2 investigators who warn readers through the disclaimer cited above.

Caution is necessary in citing the NLTS2 findings. Not included are data that speak to the issue of persons with LD who have dropped out of school. (Some estimates are as high as 33%.) Moreover, the reports of those with LD who go on to two-year postsecondary schools are encouraging, but the data are based on attendance and not completion. Similarly, employment is intricate as well. The kinds of jobs are not reported and job advancement is not tracked. Of particular significance, the longitudinal nature that characterizes the work is important, but the window of years of study is somewhat limited and may convey the wrong message. In lieu of the dearth of scholarly inquiry in this area, the NLTS2 work has much influence; however, it cannot be taken at face value.

LOW-LITERATE ADULTS WITH LEARNING DISABILITIES

Gerber (2005) reviewed the literature of low-literate adults with LD. "Low-literate" was defined as adults who do not go on to postsecondary education (the majority of the population) after leaving school-age programming. They are heterogeneous in nature, having low-average to high-average intelligence, with

a variety of profiles of intra-individual differences. The standards of the research reviewed came from three areas of guidance. The first was the November 2002 U.S. Department of Education paper *Bringing Evidence-Driven Progress to Education: A Recommended Strategy for the U.S. Department of Education*, which had as one of its central principles "scientifically-based research and education policy based on that body of knowledge" (p. 3). Second was the report that focused on school-age reading, *Putting Reading First*. Third was the October 2002 adult-focused *Research-based Principles for Adult Reading Instruction*. The three papers were heavily influenced by the rigorous scientific standards set by the National Institute for Childhood Health and Diseases (NICHD), an institute of the National Institutes of Health (NIH).

All the literature reviewed on low-literate adults with LD was done prior to the three quality standards of research listed above. In fact, the span of review was 18 years (1986–2004). Moreover, the literature was characterized as sparse and lacking the scientific rigor set for experimental and quasi-experimental methodologies. Generally speaking, research in this area was random in its focus, was unsystematic in its approach, and used convenience samples as the norm. Their only commonality was that the research sought to investigate some issue relating to adults with LD. Of the 452 documents found in the initial search, only 75 were able to be used after being vetted according to the research criteria.

What was found in the Gerber review mirrored the research review done by Scanlon et al. (1995) 10 years earlier. They had several observations: (1) there was a paucity of research in best practices, (2) research-based information did not exist or was difficult to access, and (3) most information on LD and adult literacy focused more on service delivery than research. Scanlon commented, "We do a disservice to adult literacy educators and their students with learning disabilities when we do not provide them with empirical evidence to inform practice" (p. 5).

The 2005 Gerber report was clustered into 16 areas, only a few of which are within the purview of this chapter: adult overview studies, follow-up studies, psychological profiles, neuropsychological findings, screening and assessment, cognitive skills, instructional strategies, reading, writing functional skills, career development, rehabilitation services, dropouts who are LD, poverty and LD, LD and community colleges, and employment and LD.

Gerber commented on the key findings of the research review.

> This literature review has shown that the efforts of those in the field who investigate issues about learning disabilities are following their interests rather than subscribing to a research agenda that could be helpful in providing guidance. This is understandable because currently there is not a research agenda to provide direction or directions in researching the salient and complex issues about adults with learning disabilities (p. 50).

Moreover, Gerber proffered four findings in his review:

1. The available research at this time does not provide direction(s) for evidence-based practice or systematic research programs.
2. We have little empirical evidence to be convinced that what is being done for adults with learning disabilities has efficacy.
3. There is a connection between low-literacy in adults with LD and a variety of adult adjustment issues, particularly economic issues.
4. On the basis of some research showing the coincidence of childhood and adult profiles in learning disabilities school-age methods, strategies, and instruction may also be a valuable source of education and training for adults with learning disabilities (p. 51).

SUCCESS AND SUCCESSFUL OUTCOMES IN ADULTS WITH LEARNING DISABILITIES

In the absence of any prior studies on how adults with LD become successful, Gerber et al. (1992) studied the alterable patterns (Bloom, 1980) of success in highly successful adults with LD. Their national sample comprised matched subjects (46 highly successful and 25 moderately successful), ages 21 to 65, in a federally funded qualitative/ethnographic study. The sample was thoroughly vetted and screened from a pool of 240 potential subjects. The findings generated an interactive model in which control was the overriding success variable. Control was split into both internal and external variables. Internal decisions were desire, goal orientation, and reframing, a process that had four stages. External manifestations (adaptability) contained persistence, goodness of fit, learned creativity, and social ecologies. Those adults with LD who were deemed highly successful (on five a priori success dimensions) evidenced extensive use of each of the variables in the model both individually and in combination. The moderately successful group of adults with LD showed the same use of the variables, but to a lesser degree. Severity, rather than IQ, had a significant bearing on use of the model and ultimate success. Thus, challenges in such areas as executive functioning, assorted language areas, and social skills had a marked impact on adult functioning on a daily basis.

The study proved to be seminal for the field that spawned further study and program implementation., The model was viewed as a blueprint for success, not a guarantee. Elements of the model such as reframing and goodness of fit have become part of the lexicon of those who are familiar with this body of literature as well as with the challenges of adults with LD.

Another study sought to discover the success attributes of adults with LD (Raskind, Goldberg, Higgins, & Herman, 1999) from 41 former students (14 female and 27 male) who attended the Frostig Center, a private LD school in Pasadena, California, from 1969 to 1975. The students were divided into two groups. Their groups were categorized as unsuccessful and successful according to a rating of eight dimensions of success. The longitudinal qualitative/ethnographic study sought to find the predictors of success 20 years after leaving school. They identified six "success attributes," some of which coincided with the Gerber et al. (1992) study cited above: self-awareness, proactivity, perseverance, appropriate goal setting, effective use of social support systems, and emotional stability/coping strategies. Moreover, in further analysis, they found new themes in their work (Goldberg, Higgins, Raskind, & Herman, 2003): (1) LD exerted critical influence over the life span, (2) there were differences in participants' family functioning, and (3) there were differences in participants' social relationships.

In composite, the two studies cited above provide a blueprint for what it takes to be successful in adulthood. However, there are no guarantees. Both sets of findings stress that there is an interaction between internal and external variables for success. The integrative approach of both of the models denotes a greater understanding and sophistication of the complexities of successful LD adult life. The overlap provides some validation for the findings that were derived independently.

There is no doubt that each of the derived variables is important independently, but they do have a bearing on each other. For example, it is important to reframe successfully in order to find an appropriate goodness of fit. Part of goodness of fit, however, is support. Control is not achieved without perseverance in combination with focused goals on a moment-to-moment and day-by-day basis. In essence, there are no shortcuts when it comes to success—particularly when one is LD. Moreover, there are commonalities in the formula for success whether one is LD or nondisabled. The difference is that LD is the "wild card" that can manifest itself at any time and context in a wide variety of challenges. One participant of the

Gerber study revealed in his interview, "I am always faced with the question of whether I am going to be brilliant or dumb. I never know each day" (p.18).

EMPLOYMENT AND LEARNING DISABILITIES

Murray, Goldstein, Nourse, and Edgar (2000) studied the employment rates and earnings of graduates with LD 5 and 10 years after graduation as part of a larger study titled The First Decade Project. They studied students with LD from graduating classes in three large school districts in the northwestern United States. For comparison purposes, they included in their design a group of nondisabled students matched by school district, gender, and year of graduation. A total group of 166 graduates with LD and 315 graduates without LD were studied. The number in the 1985 and 1990 graduating groups of individuals with LD were 82 and 84, respectively. An analysis of both groups revealed that there were little employment and earnings benefits associated with educational status (including postsecondary training). In both the LD and nondisabled groups, females made less money than their male equivalents. However, the limited number of individuals with LD in the sample who went on to postsecondary training was identified as a limitation of the findings. Moreover, the investigators did not identify any educational or curricular characteristics of the high school programs that the sample of students with LD attended.

Gerber (1992 a) studied the impact of the Americans with Disabilities Act (ADA) (1990) 2 years after its passage and in its first full year of implementation. He queried nine private sector businesses in the greater Richmond,Virginia, area that were major local and regional employers. He found two main categories in his analysis—perceptions of employers and expectations of employees with LD. Findings revealed that compliance with the ADA in the early implementation years was focused on physical access for people with disabilities (an issue not relevant to the LD population), and that they knew little about the characteristics and challenges of people with LD. Moreover, a set of expectations were placed on employees with LD that included self-disclosure, knowledge of the ADA, ability to explain LD and their specific strengths and weaknesses, and issues surrounding reasonable accommodation to foster effectiveness and efficiency in their work. For the first time, there was empirical evidence that responsibility shifted to individuals with LD when moving from school to employment.

A replication of the 1992 study sought to determine the degree of progress of the ADA (Price & Gerber, 2001) since its first decade of implementation had improved. Studying 13 local and regional employers in the greater Richmond, Virginia, and Philadelphia, Pennsylvania, areas, they found there was little change in the impact of the law for persons with LD. Employer responses echoed the same findings as in the 1992 study with regard to access and compliance. There was still a lack of knowledge regarding LD, and understanding of the issues of reasonable accommodation was not evident. Moreover, it was surprising that employers had not had a great deal of experience with persons with LD despite its high incidence. The pace of progress of the ADA was called into question.

Price , Gerber, and Mulligan (2003) began a line of inquiry focusing on the experiences of adults with LD in the workplace with respect to their view of the ADA as well its impact on them. In interviewing 25 adults with LD from New Jersey, ages 19–32, they found that Title I of the ADA pertaining to employment was underutilized. Disclosure of LD was rare, and reasonable accommodations were almost never a part of their employment experience.

More specifically, over half the sample believed they no longer had LD. Over two-thirds of the sample never heard of the ADA; the rest were not confident enough to use it in a self-advocacy process. None had received reasonable accommodations. Their findings

provided added insight to the first studies done in the ADA era. In summary, the investigators proffered the opinion that the realities of the workplace for adults with LD did not match the prevailing wisdom in the field of LD. After being asked the question "Is the glass half full or half empty when it comes to adults with LD in the workplace?" they commented,

> The data in the present study suggest the glass is half empty, if one uses the criteria that in the ADA era self-disclosure and accommodation are of paramount importance. On the other hand, it is difficult to say emphatically that the quality of their work life is being hampered by the distinct absence of the ADA in their work environments" (p. 357).

Similar findings were found in a qualitative study of Canadian adults with LD in employment settings in the province of Ontario (Price, Gerber, & Shessel, 2003). Twenty-four adults with LD were queried in the areas of job searching, experiences on the job, job advancement, self-disclosure, and responses of employers. Their rights were protected by the Canadian Charter of Rights and Freedoms and the Ontario Human Rights Code, a law not as extensive or disability specific as the ADA. The data revealed that disclosure was minimally used in the workplace, and the majority of participants noted success through performance evaluations and advancement. The participants felt they knew little about their federal and provincial laws, how to think about their LD, and how to explain it to others in employment settings. They had serious concerns about the consequences of disclosure. Contrary to the conventional wisdom of transition preparation, most participants got their first job through their networks of friends and family rather than a formal job-searching and job-getting process, a finding similar to the Haring, Lovett, and Smith (1990) study cited above.

When comparing the American and Canadian data sets (Gerber, Price, Mulligan, & Shessel, 2004), the researchers found a great deal of similarity in the experiences of American and Canadian adults with LD. The surprise was how similar they were despite two different workforces working under two different federal laws. The authors observed, "One would think the work experience for Americans with LD would be qualitatively more progressive than in Canada because the ADA is more far-reaching, is more specific and has more 'legislative teeth' than the Canadian Charter for Human Rights and Freedoms. Such is not the case, however" (p. 290).

DROPOUTS WITH LEARNING DISABILITIES

The issue of dropouts who are LD has not been studied recently. However, an important and well-designed study that is considered dated (Zigmond & Thornton, 1985) and outside the time parameters of this review describes a set of individuals with LD that should not be forgotten. A sample of 60 young adults with LD was compared to a nondisabled group of 61 former students. At the time of follow-up, the two groups had been out of school for 19 months—if they had graduated from high school. Those who had dropped out were out of school for a longer period, but no longer than 6 years. Data were collected via semistructured face-to-face interviews as well as reviewing school records for selected archival data

Dropout rates were much higher when comparing the nondisabled to students with LD: 32.8% vs. 54.2%, respectively. School records revealed that most dropouts from the LD and nondisabled groups left school in the ninth grade, although some students from each group dropped out in each grade up to Grade 12. Grade repetition was more common among students with LD (35%) than nondisabled students (16%). Retention was a negative school factor for each group.

Differences were evident when comparing employment rates of dropouts and high school completers. The employment rate for graduates with LD was 74.1%, compared to 87.9% of nondisabled graduates. The LD and nondisabled groups of dropouts were fairly similar in finding employment (43.8% and 50%, respectively).

Other data show a significant dropout rate among the LD population. Wagner and Newman (1991) reported that 35% of the LD population dropped out of school, twice the rate of their nondisabled peers. Later data reported from the U.S. Department of Commerce (1995) showed that 17.6% of students with LD dropped out of school. However, no data are available beyond 1995.

ATTITUDES AND PERCEPTIONS OF LEARNING DISABILITIES

When reviewing the literature on the impact of LD in adulthood, it is noteworthy to mention the attitude and perceptions of the American public regarding LD. After all, what is encountered in the interactions of adults with LD in beyond-school environments is linked to the realities of adulthood. The Roper Starch Worldwide poll (1995) was commissioned by the Emily Hall Tremaine Foundation and sought to find out attitudes and perceptions of the American public. The data were collected via telephone interviews of 1,200 adults older than 18 years old. A random-digit dialing sampling methodology was used during the month of January 1995. The poll portrayed a world that both invites empathy and poses challenges:

1 Americans recognize that learning disabilities are prevalent, yet at the same time they are widely misunderstood (p. 50). (This general finding is elaborated upon in items 2 through 5.)
2. The American public's true ignorance of learning disabilities becomes abundantly clear when asked what conditions are associated with learning disabilities. Between 60% and 85% incorrectly identified a number of conditions, including mental retardation, blindness, and emotional problems, as being associated with learning disabilities (p. 7).
3. Children are not the only ones struggling with the impact learning disabilities, and most Americans agree that adults who have learning disabilities suffer injustices as well (p. 7).
4. Eighty-nine percent of those polled believed that adults with learning disabilities suffer a lot of pain and humiliation.
5. Sixty-five percent believe that adults with learning disabilities are sometimes fired when their learning disability becomes public.

A summary table (table 17) of the findings from this section has been organized chronologically by domain.

Discussion, Findings, and Recommendations

Despite the Education of All Handicapped Children Act of 1975 and the Individuals with Disabilities Education Act (reauthorized from the 1975 law), Section 504 of the Rehabilitation Act of 1973, the U.S. Department of Education's focus on transition of students with disabilities in the early 1980s, and the Americans with Disabilities Act of 1990, there still is an inadequate research base to guide practice for adults with LD. Each one of these initiatives has provided impetus to catalyze efforts and address the needs of adults with LD in each decade. Yet the field still struggles with an adequate response to investigate the "LD adult experience" through its many phases and contexts.

In the early days, the field of LD ascribed to the conventional wisdom: "Don't worry, he or she will outgrow it." The focus then was the early childhood years (developmental) and the elementary school years (educational). As time went on, the field has moved the marker to adolescence and secondary school programming. Transition, as part of secondary curriculum, is mandated in the latter years of school for entry into the beyond-school years. Yet adulthood has been left to fend for itself. The notion of life span implications for LD, and the fact it has "persisting challenges," belies the state of the science today.

There seem to be a number of challenges that are impeding the field of learning disabilities on the issue of adulthood. First, research in the area has not adopted a conceptual model to investigate adult issues. Researchers design studies consistent with their research interests, but tend to "cherry pick" such issues as age, developmental challenges, domains of functioning, and other assorted adult issues.

Second, typically the research is lacking the context of adult development and its many phases from early to late adulthood. Often, outcomes are studied and explained in isolation; however, they are just some of the many variables that are part of the larger scheme of adult functioning. Moreover, since the study of adults with LD is difficult, convenience samples tend to predominate in research designs. Two- and four-year college students, students in literacy programs, and clients accessing rehabilitation services provide an opportunity to conduct research. Most of these samples focus on a younger adult population relative to the many years encompassing adulthood.

Third, confusing the issue is research that combines LD with other high-incidence disabilities—such as ADD, ADHD, mental retardation, and behavior disorders. Even the National Longitudinal Transition Study, phases 1 and 2, the most extensive outcome study of disabilities to date, aggregated most of its outcome data. This leaves disaggregated data specifically about LD lacking enough precision to provide informed practice for the field. Other research found in the literature is culpable as well. Despite the mantra of researchers in the field of special education in general and LD more specifically that samples should be pure, verified, and refereed with high standards of trustworthiness, a good amount of research is published without being LD specific. To make matters worse, the long-term trend of funded research from the U.S. Department of Education has focused on issues pertaining to high-incidence disabilities, while trends in funding for low-incidence disabilities has been more disability specific.

Still less is known about literacy in the context of adulthood for individuals with LD. Currently, there is no research investigating the degree of literacy adults with LD need in the variety of contexts in adulthood. Depending on the needs of adults, literacy needs can vary widely from employment, to family, to daily living challenges, to leisure and recreation—even to the degree of literacy needed in such specific areas as computers/ Internet and the broad area of health issues. We simply do not have a stratified conception of the literacy challenges of adults whose outcomes range from high success to marginally adjusted to the demands of adult life to provide guidance for best practices. Assistive technology as it pertains to literacy is also a key issue to consider. It is defined generically in the Technology-Related Assistance for Individuals with Disabilities Act of 1988 (P.L. 100-47). More specifically, it has been defined for persons with LD by Raskind (1994), as:

> Any technology that enables an adult with LD to compensate for specific deficits. In some instances the technology may assist, augment or supplement task performance in a given area of disability, whereas in others it may be

> used to circumvent or bypass specific deficits entirely…. It strives to accentuate strengths, rather than weaknesses, to enable expression of abilities at a level commensurate with intelligence, and ultimately to enhance quality of life for persons with LD (p. 152).

Assistive technology is an important part of accommodations for students with LD that are found in a variety of forms in school-age programs in both learning and testing. It also becomes an important issue when providing reasonable accommodations in adult education, postsecondary education, and the workplace under the provisions of Section 504 and the ADA. Assistive technology is known to be helpful in mastering the tasks of daily adult living as well. To date, there is no research to inform practice on the transfer of assistive technology from school-age settings to a wide variety of adult environments. Moreover, the efficacy of assistive technology in preparing adults with LD to take the GED has not been investigated.

In sum, we simply do not know the big picture when it comes to the literacy needs of adults with LD. The focus currently is on delivery of services, effective instruction, and successful completion of the GED degree .The GED is one outcome criterion; the others are more elusive. It is difficult to judge how positive outcomes could have been accentuated, and how trials and tribulations could have been prevented or mitigated with more literacy wherewithal. The following recommendations emanate from this literature review:

RESEARCH

Research on adults with LD (including literacy issues) should be focused on a disability-specific basis. Best practices should only be so identified if those practices used with an LD population have been vetted via a research effort.

Research on literacy and adults with LD should acknowledge the changing needs of literacy over the many years of adulthood (perhaps phase by phase). The field needs a "road map" on literacy needs beyond the goal of GED preparation. Moreover, research on adults with LD should be balanced on an age basis and less skewed toward early adulthood. This can be achieved through directed research competition by funding sources.

A consensus should be forged on criteria to be used when investigating the literacy needs of adults with LD and related adult issues. The field needs a conference similar to the one held in Washington, DC, in May 1983 on the state of the art of adults with LD, sponsored by the then-named National Institute for Disability Research and Rehabilitation (NIDRR) of the U.S. Department of Education to forge understandings and guidance about research directions and opportunities (Gerber & Mellard, 1985).

The field of learning disabilities needs to understand the "learning disabled adult experience" through a longitudinal lens. More extensive studies need to focus on learning disabilities and literacy on an adult phase-by-phase basis.

PRACTICE

There are myriad issues for adults with LD that are found in a variety of adult contexts. Strategies for education and training should be geared to the specific challenges and issues of persons with LD. A "one size fits all" approach is not effective and efficient when working with adults with LD. Thus, individualization in process and content is important in working with adults with LD.

Education and training should be geared toward strengths, interests, motivation, and existing skills. The focus should be skill development and strategies that focus on what potentially is the niche of the LD adult. Identifying a potential niche provides focus for education and training efforts.

Dependency can be an issue and is counter to the life skills that all adults, particularly those who have LD, need to navigate a variety of settings. Persons who engage in education and training need to be mindful that independence is critical in thought and action in individuals with LD. Moreover, it is the underpinning of self-determination.

PRACTICE

All education and training interactions should have as one of their goals the development of self-understanding relative to one's LD. Self-understanding can be built upon to enable LD adults to engage in a series of important self-determination actions such as self-disclosure and self-advocacy.

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Table 17

Summary of Findings Regarding Impact of Learning Disabilities on Adulthood by Domain

LD-related Skills	Impact on Adulthood
Rogan & Hartman (1986) n = 88	Reading, math and spelling still a challenge. LD no longer dominant feature in adult lives.
Johnson (1994) N = 14	Small gains via educational tutoring.
Hellerendoorn & Ruijssenaars (2000) N = 27	Dyslexia impacts further education.
Gerber et al. (1990) n = 133	Listening, speaking, coordination, impulsivity worsen; stability in speaking and spelling.
LD and Self-Determination	
Gerber (1992 a) n = 9	Employers expect self-disclosure, knowledge of ADA, self-knowledge, and reasonable accommodation issues of employees with LD.
Holliday, Koller, &Thomas (1999) n = 30	95% of sample were not told of their superior abilities in school or by vocational rehabilitation services; information not used in vocational choices.
Price & Gerber (2001) n = 13	Same findings as Gerber (1992 a) study despite time span.
Price, Mulligan, & Gerber (2003) n=25	Disclosure rare, accommodations rare, ADA underutilized, lack of confidence to use ADA.
Price, Gerber, & Shessel (2003) n = 24	Disclosure minimal, little known about rights, very little self-advocacy.
Success and Learning Disabilities	
Spekman, Goldberg, & Herman (1992) n = 50	Support was a significant protective factor. Competence related to factors such as coping, perseverance, goal-setting, and acceptance of strengths and weaknesses
Gerber & Reiff (1991) n = 9	Success function of education and lack of severity. Moderately successful easier time navigating adult challenges; marginally adjusted are dependent on others.
Gerber, Ginsberg, & Reiff (1992) n = 71	Highly successful "in control" of their lives. Extensive use of variables identified for success. Moderately successful use variables but do not maximize. Severity rather than IQ affects success outcomes.
Goldberg, Higgins, Raskind, & Herman (2003) n = 41	Six success attributes that persons with LD can utilize positively in a variety of settings

Employment and LD	
Haring, Lovett, & Smith (1990) N = 64	Unemployment twice the national average. 87% happy with jobs. Jobs found through family and friends. Postsecondary education did not enhance employability.
Murray, Goldstein, Nourse, & Edgar (2000) n = 44	Little employment of earnings benefits associated with educational status. Females with LD make less earnings than males.
NTLS2 (2004) n=11,000	75% employed at least one time since leaving high school.
Seo (2005) n = 60	Rate of LD employment less than general population.
General Adjustment Issues	
Haring, Lovett, & Smith (1990) n = 64	Minimal adult adjustment. General satisfaction with social and recreation aspects of adult life.
Hellerendoorn & Ruijssenaars (2000) n = 27	Social and emotional problems in adult lives
NTLS2 (2004) n = 11,000	Decline in participation in volunteer organizations. Brushes with law not as common. Passive leisure pursuits common.
Gerber (2005) n = 75	Connection between low literacy and adult adjustment, particularly economic issues.
Seo (2005) n = 60	No difference than general population in community crime. More incidence of depression than general population.

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